DEPARTMENT OF AGRICULTURE

BRITISH EAST AFRICA.

ANNUAL REPORT.

1917-1918.

IMPERIAL BUREAU

NAIROBI.

PRINTED BY THE GOVERNMENT PRINTER.

1921.

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ANNUAL REPORT

OF THE

Agricultural Department,

for the year

1917-1918.

DEPARTMENT OF AGRICULTURE,

NAIROBI,

September, 1918.

THE HON. THE ACTING CHIEF SECRETARY.

Sir,

I have the honour to submit my Annual Report of the Agricultural Department for the year ending 31st March, 1918, together with reports of the Chiefs of Divisions and certain other Officers of the Department.

The past year has been one of the most trying on record for the Agricultural Community during the history of the Protectorate.

This has been due to a number of causes, among which the following may be ennumerated:—

(1) The continued absence in connection with war duties of many of the country's most important farmers and planters, the resulting loss of man-power and energy which would have been devoted to development is clearly to be seen on every hand.

(2) In the second place it almost seemed that nature herself was frowning on the Protectorate, the climatic conditions being most unusually adverse to Agricultural operations, for in the early portion of the year such deluges of rain were experienced as "drowned" the crops in many districts, and during the later period these excessive rains were followed by a drought, with the result that a failure of crops was general throughout many districts. As is always the case in such circumstances the cultivation by natives suffered most severely by reason of the ignorance of the owners of up-to-date methods to control and fight against these abnormal conditions. Surface draining to carry off excessive moisture on

the one occasion and a well kept surface tilth to conserve it on the other, would, undoubtedly, have saved much of the crops lost by the failure of the native population to carry out such precautionary measures. Where these ill worked native owned "shambas" were adjacent to properly conducted farms under European supervision the contrast was very marked. Efforts were made by the Department to improve this state of affairs and officers were delegated to visit certain districts to point out by actual demonstration the benefits following improved methods of cultivation; however, the extremely limited number of officers available for this purpose rendered, of necessity, the resulting improvement to be contained within but small areas of the very large native reserves; these efforts cannot at present be said to have materially ameliorated general conditions and the state of famine which followed.

This shortage embraced:—

(*a*) Foodstuffs from "short period" crops both European and native grown.

(*b*) Seed for subsequent sowings.

(*c*) Stock food.

To meet the difficulty in connection with the food shortage (*a*) the Government had to import large quantities of maize. It may, however, be mentioned that the quantities of foodstuffs purchased by the military authorities for necessary supplies for war purposes had brought the usual food reserves down to a low point, this would not occur in normal times, when these reserves would probably, if not entirely solve the difficulty, at least minimize its effects.

The famine caused a lack of seed, the supply having been consumed as food. It was hard at first to ascertain the quantities that would be required in the various districts needing seed from the local authorities, but as soon as the information came to hand the Department made every endeavour to arrange the purchase and distribution of the required supplies. In particular, the whole amount of bean seed in sight was bought up and sent to the districts where all the seed had been consumed. Importations of rice paddy from India were ordered for the coast area, it is regretted that through unforeseen delays some of this seed came to hand too late for the season under review, but this will be made use of in the coming rains. Quantities of maize imported from South Africa by the Famine Committee were used for seed purposes where the local demand was in excess of the supply. On the whole the situation was dealt with in a satisfactory manner.

With regard to stock feed, this is a question which with our at present small, though increasing herds, has not up till recently caused great anxiety on the part of stock farmers, their ranches as a rule providing a sufficiency of grazing and fodder. The country is now becoming much more "stocked up," and the past season has brought with it the lesson that the provident stock owners must make provision in addition to that with which nature

customarily affords, and it is greatly hoped that the mowing and conserving of grass hay, making of ensilage, and the growing of fodder crops will receive more attention than has been the case up till now.

(3) Importers of Agricultural implements and machinery have found it ever harder to cope with the orders of their customers. These importations being an essential factor in the development of the industry, representations were made by the Government to the Home Authorities controlling manufactures and shipping and the position clearly explained. We have been informed that this is thoroughly understood and every facility possible under present circumstances will be granted to real requirements; but the situation must be looked at from a broad point of view and the proportionately small importance of our interests compared with the immense issues at stake in the war struggle cannot receive more than their just due from the authorities concerned. As regards wagons and trek gear the military were approached and kindly arranged, in conjunction with the Department, that sales should be held at convenient centres; these sales met the immediate need, and the lack of transport requirements in this connection is no longer grave.

(4) Another obstacle in the path of progress which has confronted the community with regard to the curtailment of shipping and export facilities is the disposal of certain products which were judged not immediately required on the markets where formerly they were readily placed. Coffee planters were peculiarly affected and Government early realized the serious position of these persons who had invested their capital in their undertakings and were unable to continue their operations if the produce of their plantations could not be placed on the market. Measures for relief were introduced and also the state of affairs was kept before the Colonial Office who from time to time were able to arrange that a fair proportion of Coffee beans were shipped. Other channels of disposal were not overlooked, the South African market in particular received special notice, with the result that a certain quantity of coffee has been sold there.

(5) The Government having made public the fact that it was considered necessary the Protectorate should so far as possible produce its own requirements, the attention of the community was at once directed towards supplying by local production these commodities which could be substituted for those imported. Bread, as the most essential food, was, of course, prominent and the Department took steps to stimulate and encourage the growing of wheat. For increasing the area under this and other necessary crops it was found that the number of draught oxen owned by farmers was insufficient. The large number formerly bought by the military authorities for transport purposes accounted for this. The Government therefore arranged the purchase of some 5,000 draught animals through the Department for distribution by the local War Committees, a scheme which has been carried out successfully.

(6) The extraordinary climatic conditions referred to in paragraph (2) brought in their train such a host of insect and fungous pests as have never previously been experienced. Stock diseases have also been rampant; full particulars of these pests and outbreaks of diseases will be found in the report of the Department's Officers concerned with the control thereof.

(7) It cannot be a matter to be wondered at that the prices of agricultural produce have increased to a height previously unknown; it is, however, a matter of opinion whether these present abnormal prices are in all cases justified, or if lack of organization is not to some extent responsible. Time will doubtless show proof should the latter point of view be a sound one.

(8) The discontinuation of the alienation of land during the period of hostilities has checked agricultural development.

It must not be thought, however, that the disadvantages which have been felt during this year have brought nothing but evil; the fact that the Protectorate has been asked to exert all its energies in the first place to become so far as possible self-supporting as regards the products it can grow for its own consumption, and in the second place to increase the exports of those industries, such as sisal and flax, called for by the Empire's needs, made the country as a whole realize that these disadvantageous circumstances, which in ordinary times would have worked for a state of depression, must not now be allowed to do so, but act rather as an incentive to further effort towards a patriotic increase in cultivation and production, and this wide held sentiment has generally speaking been loyally acted upon by the Protectorate's Agriculturists.

The tendency towards combination and co-operation continues to make its influence felt, and, though many of the Associations formed from time to time with this object in view have not as yet become established permanently, yet signs are not lacking that this condition of flux will be succeeded by one of lasting usefulness of these bodies.

It will readily be understood that the circumstances related above have caused the work of the Department to increase enormously, the wholesale purchase and distribution of draught animals and seeds alone has occupied much time. Research, field trials, and experiments with new crops have been of necessity curtailed, the staff at the Kabete Experimental Farm has again been largely employed in Dairy work for the supply of milk to Military Hospitals.

The writer's own time has been greatly taken up in duties in connection with war conditions; on the whole, however, the agricultural community has realized the difficulties under which the Department is striving to carry out its duties, but some few have failed to grasp these facts, and to these I would plead that patience should be shown until the times allow of that greater efficiency and usefulness which are the objects of the whole Department.

I dealt with land conditions at some length in my 1916-17 report, and it is not proposed to again recover the same pionts but rather to take up the main Agricultural Industries at the point left off last year, and report what progress has been made in the interval with suggestions as to further possible successful development.

The Animal Industry—Cattle.

It is to be regretted that this year has proved to be a bad one for the cattle industry generally. Extensive outbreaks of disease were largely responsible for this result but another important factor was the failure of the "short rains," with the consequent mortality from lack of grazing, especially in the native reserves, the natives owning aproximately 7/10ths of the cattle in the Protectorate. The principal diseases responsible for the losses were Rinderpest, East Coast Fever, Pleuro-pneumonia, and Anthrax, and the economic loss was considerable.

The Veterinary Department was considerably understaffed owing to the number of officers who were engaged on military duty, with the result that no organized attempt could be made to deal with outbreaks of disease in native reserves. Every effort, however, was made to cope with outbreaks in the European settled areas where movement of stock could be controlled, and the results reflect credit on all the officers concerned. Over 31,000 head of cattle were double inoculated against Rinderpest during the year, and further details will be found in the attached report of the Acting Chief Veterinary Officer.

East Coast Fever spread considerably during the year as, owing to the high price of cement, the erection of cattle dipping tanks was practically suspended. This disease will continue to cause a considerable amount of anxiety to stock owners until dipping tanks have been erected along the main stock routes, so that all cattle moving along these routes can be regularly dipped.

The military demands for transport oxen in the past resulted in a serious shortage of work oxen for Agricultural purposes, and as it became necessary, owing to the shortage of shipping, to rely largely on locally grown foodstuffs, the position was so grave that the Government made arrangements with the Military Authorities to sell untrained oxen to farmers to replace those which had been commandeered. In this way the agricultural requirements of the country have largely been met, and it is hoped that further supplies of oxen will soon be rendered available to meet all reasonable demands.

Although large numbers of oxen have been supplied to the Military Authorities for food purposes, it must be remembered that these cattle do not represent any economic loss to the country, as those selected for this purpose were drawn from native reserves, which owing to the prevalence of certain diseases could not be purchased by settlers for draught and development purposes.

It must be recognised that although the cattle industry is one of the most important industries of this Protectorate, it never can be developed to any great extent until there is a demand for meat for export purposes, and until dairying receives more attention. The meat at present available for export is of poor quality and could only be exported profitably as canned meat, but, if an export meat trade were established, capital would be at once attracted to the country and suitable breeding bulls would be imported in such numbers that, in the course of a few years, beef of prime quality would be available for export in the frozen or chilled state.

The need for suitable pure bred bulls is so great even at present that the Government made arrangements to obtain a supply from South Africa, and the writer was instructed to proceed to the Union to make purchases; some 73 head of pure bred bulls were bought, and it is hoped that further purchases will be made not only from the South but also from Australia and Great Britain. With the provision of a sufficient supply of suitable breeding bulls for grading purposes the value of the stock industry could be greatly increased.

It is estimated that there are now over 2½ million head of cattle in the Protectorate and, after allowing for local requirements, losses from disease, etc., it is considered that upwards of 80,000 bullocks should be available annually for export. This would represent over 8,000 tons of beef, worth at least £240,000.

From the point of view of meat inspection the chief drawback to East African meat is the prevalence of "measles" (a stage in the development of one of the human Tapeworms), and it will be necessary to free our pastures of this parasite before the East African frozen meat trade can be placed on a firm basis. This problem, however, does not present insuperable difficulties, and could readily be solved by the introduction of compulsory sanitary measures on stock farms and in native reserves.

Sheep.

The sheep industry, in as far as the European settled areas are concerned, has continued to give the same hopeful indications as in previous years.

Considerable losses among sheep have occurred, however, in the Masai Reserve, which is the main reservoir for the supply of our native ewes. The cause of these losses was mainly strongylosis ("Wire worm"). A remedy for this disease has been discovered at the Onderstepoort Veterinary Laboratory in South Africa, and experiments are being conducted in this country with a view to ascertaining if the doses recommended can be safely administered to native sheep. As soon as the proper doses have been ascertained little difficulty should be experienced in eliminating this disease, which is, at present, the cause of considerable anxiety to sheep farmers.

The export of wool both from pure bred and grade sheep shows a marked increase over that of last year, while the prices realized were considerably higher.

Pigs.

During the first six months of the year under review this industry was developing rapidly, and besides satisfying local requirements large quantities of Bacon and Ham were supplied to the military. In the latter half of the year the supply of these products fell off considerably owing to the failure of crops, and the consequent high prices ruling for food for fattening and finishing off pigs for slaughter. But the industry may now be said to be established, and with the elimination of the Seychelles blood originally introduced, and the breeding of only the best English breeds it is anticipated that pig raising will become a very important accessory branch of farming on many of our holdings, and more especially as it is one which can be started with a small capital and from which quick returns can be expected.

FIBRE CROPS.

Sisal.

The rise of prices at home for fibres, and especially for sisal for rope and twine, has given a great impetus to the development of this country, and large areas of virgin land in many of the districts of the Highlands have been ploughed and planted during the year. It is now estimated that some 25,000 acres are under sisal, and were more work oxen available a still larger area would have been put under cultivation.

Flax.

Owing to the very high prices ruling for this fibre the industry has become thoroughly established, and the areas under the crops and consequent output are rapidly increasing.

Seed shortage and the difficulty of obtaining machinery have held back the advance of the industry to some extent, but Government is doing all in its power to help in these matters, and it is expected that any delays will prove but temporary; this is so much the more important as the Home Government has asked that flax exports should be largely increased, a request with which every effort is being made to comply.

The services of the Flax Instructor have been in great demand, and numerous expressions of gratitude for the good results by following his advice have been received. Factories are becoming more numerous and of larger capacity. Two or three regrettable fires have occurred, but greater precautions are being taken whereby it is hoped these will be prevented in the future.

Results of Government trials will be found in the Instructor's report.

This officer is now at work preparing a revised and up-to-date Bulletin on the crop.

Coffee.

Further information as to the history of the introduction of coffee has come to hand, and the statements made in my Report for the year 1913-14 require some amendment, full particulars are now given by the Entomologist in his report.

The coffee planter has this year laboured under great trials. The lack of shipping and home demand for coffee beans gave rise to grave anxiety, and the Government held it imperative to make strong representations to the Home Authorities on the position of coffee planters in the Protectorate should they be prevented from exporting. These representations resulted in a certain number of facilities being granted, and quantities of beans were exported and obtained record prices. A considerable amount, however, remains, but at the time of writing there seems every prospect of the whole of the balance being exported before long.

Many coffee plantations suffered severely from the drought *Hemileia vastatrix*, a new disease, Phoma, Thrips, Antestia and other pests, at present it seems more than probable that the coming crop will be small.

At the desire of a number of coffee planters and dealers, an Ordinance regarding the Registration of Coffee Plantations and Dealers has been introduced, and become law.

The Coffee Planters' Union continues to carry out most useful work, and its members reap considerable benefits through its activities.

The Coffee Plant Inspector since his return from military duty has had his time fully occupied in visiting plantations and advising planters.

Maize.

This most important crop suffered very severely through the adverse season, and the produce proved insufficient for local needs, the prompt measures adopted by the Famine Committee are, however, it is hoped, averting to a great extent the peril of famine.

This Department has endeavoured to collect and redistribute seed where necessary.

Wheat.

I have already alluded to the efforts which have been made to stimulate this industry.

It is reported that the approximate area which is being put under cultivation is 10,000 acres, this area would have been much larger if a guarantee could have been given that the importation of implements and machinery would take place. Several varieties such as Golden Ball, Equator and the Kabete hybrids are proving most successful.

Barley and Oats.

There is nothing further to add to my remarks of last year regarding these crops.

Potatoes.

For much the same reasons which I now state as resulting in shortage of other crops, there was during the latter months of the year under review a great lack of edible potatoes on the local markets, prices as high as Rs. 15/- per load of 60 lbs. obtaining.

However, a good crop is now being harvested, prices have dropped and the shortage, for the present at any rate, is at an end.

The Department has long realized the importance of introducing fresh breeds of potatoes from other lands, but under present conditions this has been difficult. Small quantities of seed were procured from Europe, but adverse seasons at Kabete, and the sudden rising of the lake at Naivasha, which covered the potato field, have prevented the Department from providing the quantities of new seed it was hoped would have resulted from this importation. For this reason it was felt that efforts must be made to bring in new seed from South Africa, this has now been done and the seed has arrived in Nairobi and is being sold.

Beans.

There has been a very grave shortage of bean seed and the Department has been very busy buying up visible supplies, and arranging distributions and sales in the districts where the seed had all been eaten. As this distributed seed was of imported varieties such as Canadian Wonder and Rose Coco, it is hoped that a considerable improvement in the general standard of the bean crop of the Protectorate will result.

As a measure of precaution the exportation of beans has been prohibited for the time being.

Peas.

As I have stated in previous reports it is anticipated that a lucrative export trade in seed peas will follow the coming of normal times.

Sugar-cane.

Renewed activity of a practical nature is being displayed in sugar-cane growing over a wide area of the Protectorate. The subject has been kept well in mind by the Department of Agriculture, and new trial plots, with several varieties laid out at the Experimental Farms at Kabete, Kibos and Mazeras. Cane plants from these institutions are also much in demand by settlers. Among the districts where cane-growing has already been taken up are Kibos, Muhoroni, Koru, Donyo-Sabuk, Kyambu and Masongaleni. Plots of cane for trial and nursery purposes have been established by planters in several parts of the Coast belt.

Companies and Syndicates have been formed for the purpose of sugar growing in the Protectorate, and other companies are in course of formation.

Ever since the establishment of an Indian settlement at Kibos, small fields of cane were grown by the allottees for converting into jaggery, and for sucking in the raw state, and at the present time it is estimated there are about 250 acres of sugar cane being grown by Indian settlers in the Kibos locality.

In the Muhoroni district several settlers have established trial plots of sugar cane on their estates. A large tract of land in this locality, and in the country lying along the Railway between Muhoroni and Kibigori Railway Stations is considered to be admirably adapted for sugar cane growing, the soil being rich, temperature high and the rainfall one of the largest in the Protectorate.

On the Koru estate a field of Striped Ribbon and White Transparent varieties of cane is established, the plants having been supplied from the Government Experimental Station, Mazeras. The growth of both varieties is excellent, but especially the Stripped Ribbon, which is undoubtedly exceptionally well suited to the district.

In the valley between Muhoroni Railway Station and Koru, an area of about 700 acres is established in sugar by Indian settlers. The cultivaiton, however, is not up-to-date methods, and the means for milling the canes and converting the juice into jaggery are also crude and entirely inadequate.

The installation of a central factory in this district, or an adjoining one, would, it is thought, provide facilities for making sugar of first rate quality, and at the same time encourage cane farming generally on the lower lands in the locality.

Similarly there is an extensive area of land well adapted to sugar cane situated on the North side of the Railway in the stretch of country between Kibos and Kibigori.

The area of land here is also such as would warrant the erection of an up-to-date sugar factory capable of turning out probably some 5,000 tons of sugar per annum.

Swamp Rice.

Over twenty tons of seed rice were imported from India by the Department of Agriculture, for distribution or sale, in connection with the efforts made by the Government to encourage the growing of foodstuffs in the Protectorate in view of famine prospects.

The resuscitation of rice growing in parts of the Coast belt was continued by the Administrative Officers, and others acting in conjunction with them, and the results were reported to be of an encouraging nature, the yield per acre being in some instances trebled, owing to the practical supervision and assistance given by the officers concerned.

Hill Rice.

The season was not propitious for these experiments, a further importation of seed has been arranged.

Coconuts.

Although the extension of coconut planting was not as great as in the past few years, nevertheless further progress was made and the established estates were all kept in cultivation as far as a somewhat lessened labour supply admitted.

Efforts to check the ravages of the Beetle were continued by the Department of Agriculture in the districts around Mombasa, Changamwe, Freretown, Rabai, &c., &c.

For administrative reasons the proposed Ordinances have not yet become law.

Castor-Oil Beans.

From time to time enquiries come to hand asking for information in regard to the prospects of Castor-oil Bean growing in the Protectorate.

The plant is met with in a semi-wild state practically throughout the Protectorate, and although it is a crop that could be grown by natives, there are so many other crops which give so much better returns such as beans, maize, and potatoes, that the inducement to cultivate castor-oil beans has not proved sufficient.

Further information regarding this plant as a food for the Eri Silk Worm will be found in the Entomologist's Report.

Wattle.

The progress that has been hoped for in organization and subsequent building of factories has been once again delayed, but I understand that a firm has now definitely decided to erect a factory at a central position, and with the present demand for wattle products its financial success seems assured, indeed the prospects of the whole industry are much brighter to-day than for years past.

Tanning projects in combination with this industry are also to the fore.

Rubber.

There is no progress to report under this heading, the Ceara rubber plantations still almost entirely remaining unworked, mainly owing to the low price obtained for this quality of rubber, and shortage of skilled labour.

With regard to Para which is doing so well in the neighbouring Kingdom of Uganda, the rainfall and humidity conditions of the Protectorate have not proved sufficiently high for Para in such parts where the trees has been tried, but more data are needed to finally dispose of the matter.

Citrus and other Fruits.

The citrus industry is still in the experimental stage as regards export of the products and it is too early as yet to make any definite statement as to the prospects of the industry, which, however, appear to be good.

Precautionary measures against the introduction of insect and fungous pests have been taken. The cultivation of deciduous fruit trees continues to be a great success in the Machakos and Donyo Sabuk districts.

Tobacco.

Under present circumstances it was felt that work on this crop must for the present give way to more promising industries, and the Advisor was employed in assisting at the Head Office.

Staff.

The following officers of the Department proceeded on leave during the previous year and returned as under:—

Officer.	*Date Returned.*
Mr. A. C. MacDonald ...	2nd Feb., 1918.
Mr. H. S. Land ...	22nd April, 1917.
Mr. W. J. Dowson ...	2nd April, 1917.
Mr. N. A. McGregor ...	4th July, 1917.

Mr. F. W. Dry, Assistant Entomologist, arrived on first appointment on 15th May, 1917.

Mr. H. Simpson, Flax Instructor, arrived on first appointment on 2nd April, 1917.

Mr. G. Farmer, Tropical Agricultural Instructor, severed connection with the Department on the expiration of his leave in England on 11th Sepetmber, 1918.

Mr. J. J. Adams, Agricultural Instructor, severed connection with the Department on the expiration of his leave, spent locally, in March, 1918.

The following members were on Military Service during the year.

1917-1918.

Mr. L. D. Carpenter.
Mr. H. B. Simson.
Mr. W. J. Johnson.
Mr. C. B. Armstrong.
Mr. H. B. Sharpe.
Mr. A. D. le Poer Trench enlisted on 27th April, 1917 and was discharged on 27th November, 1917.
Mr. J. D. Ritchie, discharged 18th November, 1917.

The staff carried out their duties to my satisfaction, and my thanks are due to them for the way in which they undertook much extraordinary work, which their depleted numbers and the abnormal circumstances rendered necessary.

Meteorological Returns.

The usual rainfall returns are appended.

I have the honour to be,
sir,
Your obedient servant,

CHRIS. J. MONSON,
for Director of Agriculture

Rainfall Records, British East Africa, 1917.

No.	Station and Observer.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total.	Remarks.
2	Athi River, Kenani Fibre Lands...	2·44	4·33	3·45	4·83	2·70	3·96	0·00	0·13	0·15	0·60	0·67	0·00	23·26	
3	„ „ Station, U. Rly. ...	1·98	4·71	3·96	9·72	1·47	4·26	0·13	0·33	0·06	0·17	0·82	0·00	27·61	
4	Butere Nr. Mumias, A. J. Leech...	5·73	9·82	1·75	15·38	12·71	4·93	4·42	7·26	12·31	11·31	1·97	1·04	88·65	
7	Chania Bridge, R. G. Henderson.	4·49	2·23	4·12	8·49	5·16	2·82	0·63	1·07	0·26	3·77	1·20	0·10	34·34	
6	„ „ A. R. Cuninghame.	5·47	4·38	6·33	13·59	5·98	3·01	0·91	0·66	0·55	4·01	1·29	0·00	46·18	
173	„ „ J. W. L. Focks ...	5·62	1·80	3·77	11·41	2·40	8·16	0·61	0·61	0·12	2·62	4·23	0·00	41·35	
8	Chuka, District Commissioner ...	5·92	4·60	10·87	18·71	6·60	4·57	0·84	1·35	0·33	6·81	4·48	0·21	65·29	
9	Dagoretti, District Commr. ...	3·51	3·64	—	—	6·30	3·98	—	—	0·80	1·75	—	—	19·98	6 months.
181	Donyo Sabuk, P. O. Machakos, J. Stuart Watt	4·90	1·27	2·58	7·25	1·67	4·27	0·22	0·28	0·00	3·41	5·91	0·02	31·78	
10	Escarpment, Forest Station ...	4·96	7·85	11·24	17·23	13·78	3·16	3·20	2·67	1·61	1·44	0·48	0·00	67·62	
11	Eldama Ravine, D. C. ...	2·60	3·37	1·56	10·78	14·34	7·74	9·97	9·57	5·49	6·20	0·54	0·19	72·35	
12	Elmenteita, R. Chamberlain ...	1·35	3·13	2·23	10·26	5·93	7·17	7·10	7·01	3·55	4·22	0·76	0·10	52·81	
13	Embu, D. C.	3·05	1·30	7·86	19·52	3·71	3·46	0·73	0·94	0·41	3·37	1·18	0 01	45·54	
15	Fort Hall, D. C.	6·01	5·14	3·87	22·67	5·91	4·45	0·64	1·52	0·23	4·84	3·90	0·00	59·18	
164	„ „ Kaichangro Rev. Father I/C	—	—	4·95	16·83	5·40	4·41	1·60	1·07	—	2·25	2·70	—	38·61	8 months.
165	Fort Hall, Wambugu, Rev. Father I/C	0·75	2·30	3·57	36·72	4·59	5·57	10·91	4·20	3·22	5·28	6·17	4·21	87·49	
166	Fort Hall, Igochi Rev. Father I/C	4·94	2·32	6·57	23·30	12·44	5·60	0·94	2·20	0·37	15·25	5·28	0·00	79·21	
17	Fort Ternan, Ross Bros. ...	1·25	—	2·52	11·57	7·36	8·44	2·13	9·41	4·32	5·50	1·08	0·81	54·39	11 months
19	Gazi E. A. Estates	0·40	0·94	1.63	12·33	8·41	2·88	2·31	2·16	0·00	1·07	3·05	0·00	35·18	
20	Gendia, Kisumu Missioner ...	7·40	6·34	4·34	11·53	5·34	3·50	0·34	3·61	3·96	4·49	2·01	1·08	53·94	
22	Gyriama, Nyaka District, A.D.C.	4·97	0·28	3·02	2·26	4·11	1·84	1·41	0·77	0·16	0·10	3·08	0·36	22·36	
5	Kabarnet, A. D. C. ...	0·70	3·82	14·74	14·41	14·41	10·32	10·32	20·41	8·82	6·62	0·73	0·00	105 30	
7	Kabete Farm, Kikuyu, Manager...	6·30	3·57	8·11	16·08	7·16	4·94	0·67	2·13	1·94	5·18	1·70	0·07	57·85	
26	Kabete Laby., Vtry. Pathologist...	6·41	3·53	8·77	12·71	7·87	6·05	0·69	2·66	2·07	4·74	1·61	0·11	57·22	
25	Kaimosi Mission, Kisumu ...	6·97	6·21	2·46	13·48	12·72	7·37	3·26	12·01	10·14	9·74	1·05	0·43	85 84	
31	Karura, Forest Station ...	5·50	5·73	5·67	17·64	6·75	4·31	2·01	1·90	1·13	3·92	0·96	0·00	54 52	
107	Kacheliba, D. C.	1·55	1·22	1·02	7·48	4·31	2·84	6·47	7·07	3·00	4·79	0·00	0·00	39·75	

Rainfall Records, B. E. A. 1917.—(*Contd.*)

No.	Station and Observer.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total.	Remarks.
56	Londiani, Forest Station ...	1·35	1·07	1·90	7·98	5·76	5·80	3·52	5 68	7·96	4·19	1·02	0·00	46·33	
62	Londiani, Farm 1521, J. J. Drought	1·76	—	2·03	10·34	9·02	4·81	3·87	–	—	—	—	—	31·83	6 months
59	Lumbwa, U. Railway ...	4·63	2·35	2·67	11·86	5·23	7·34	4·32	5·65	9·64	7·20	0·34	0·00	61·23	
180	Lumbwa, C. McDonald ...	1·74	3·50	1·50	12·59	10·08	7·60	4·00	9·20	9·89	8·67	0·41	0·04	69·22	
64	Machakos, D. C	9·25	4·81	8 95	6·00	3 85	3·90	0·00	0·00	0·00	0·65	2·00	0·30	39·71	
183	Machakos, Potha, P. H. Percival..	—	—	—	—	2·53	3·52	0·00	1·00	0·00	0·34	2·29	0·00	9·68	8 months
65	Mackinnon Road, Uganda Rly. ...	2·42	2·63	1·80	4·28	1·81	0·00	0·00	0·79	0·11	0·09	4·37	2·06	20·36	
66	Makindu, Uganda Railway ...	5·32	0·25	5·81	3·67	2·47	0·00	0·00	0·00	0·00	0·00	0·00	0·00	17·50	
67	Malindi, D. C.	0 00	0 00	8·70	6·45	6·43	3·42	2·11	0·00	0·00	0·00	0·00	0·00	27·11	
163	Mara Station, Masai Reserve, D. C.	5 97	4·16	2·93	9 59	3·16	2·61	1·03	4·53	6·73	5·32	0·36	1·33	47·72	
162	Marakwet, D. C.	2·36	4·27	1·91	19 04	13·52	2·30	4·53	7·14	6·89	6·94	1·29	0·35	70·54	
69	Moyale, N. F. D. O/C ...	0·63	0·52	0·23	13·36	5 78	3·62	0·42	0·28	0·00	5·27	0·55	0·27	30·93	
70	Maseno, Kisumu, E. A. Industries	3·43	7·97	4·41	18 94	11·35	6·97	1·59	5·37	9·08	13 38	2·16	1·09	85·74	
71	Masongaleni, Uganda Railway ...	4·07	3·06	8·16	5·42	0·67	0·70	0·00	0·00	0·00	0·00	3·43	0·07	25·58	
72	Mazeras „ „ ...	—	0·96	1·07	8·07	4·55	2·05	0·55	0·00	0·00	0·40	3·85	0·30	21·80	11 months
90	Meru, D. C.	7·66	2 18	8·38	20·27	10·33	3·22	0·48	2·10	0·00	7·95	5·21	0·00	67·78	
167	Meru, Tigania Rev. Father I/C ...	0·00	0 00	6·50	15·49	9·72	0·00	0·00	0·00	0·00	—	3·10	—	34·81	10 months
168	Meru, Imenti „ ...	5·34	2·41	6 71	22·75	12·87	5·17	0·78	2·10	0·13	5·10	7·26	0·24	70·86	
169	Meru, Igembe „ ...	4·94	0·64	11·06	34 15	10·99	4·20	—	—	—	11·52	4·91	—	82·41	8 months
77	Molo, Overhaddon, Abraham Bros.	1·15	4·31	2·76	10·40	9·89	12·14	5·88	17·36	8·13	12·33	2·66	0·77	87·68	
184	M'funa via Gosha D. C. ...	0·80	0 30	0·75	4 33	5·55	1·18	0·19	0·30	0·01	5·86	—	0·00	19·27	11 months
78	Molo, Uganda Railway ...	3·68	2·44	3 22	7·66	11·21	9·54	6·13	9·31	8·76	7·53	0·85	0·72	71·05	
176	Molo, Equator Saw Mills ...	3·74	2·82	3·58	7·84	9·11	6·90	6·02	7·14	4·47	7 23	0·81	0·42	60·08	
76	Mombasa, P. C.	2·33	2·26	2·45	17·14	7·97	2·05	1·87	2·03	0·96	0·51	0·45	0·81	40·83	
73	Mombasa, Mto Panga Estate ...	0 96	0·52	0·29	15·56	8·56	2·27	1·81	1·08	0·54	0·18	0·66	0·92	33·35	
74	Mombasa, M'twapa Estates ...	1·51	1·00	4·14	7·75	9·80	1·88	—	—	—	—	—	—	26 08	6 months
75	Mombasa, Nyali Sisal Estates ...	1·60	0 94	0·75	16·87	7·72	3·05	0·70	0·70	0·35	0·33	0·33	1·20	34·54	
80	Mua Hills, Machakos, A. Milne ...	6·84	7·81	5·23	5·56	2·78	5·55	0·10	0·00	0 00	1·30	2·15	0·13	37·45	
82	Muhoroni, Ngirimori Estate Koru	2 93	6·86	4·09	11·52	9·71	5·13	2·28	13·25	5·01	7·04	2·38	0·27	70·77	
83	Muhoroni, Uganda Railway ..	0·85	4·50	0·80	20·30	17 60	1·85	1·70	4·03	2·72	6·64	1·72	0·34	63·05	

Rainfall Records, B. E. A. 1917.—(*Contd.*)

No.	Station Observer.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total.	Remarks.
35	Kericho, D. C.	5·94	8·6	2·81	17·77	9·22	10·44	3·07	5·54	8·40	9·80	2·34	0·78	84·74	
34	„ Lumbwa Industrial Mission	4·84	10·08	3·89	13·20	14·13	9·28	5·70	8·80	7·90	8·24	1·41	0·62	88·09	
33	Kericho, Orchardson Bros. ..	5·21	10·08	3·91	11·79	12·95	8·32	2·88	7·85	8·17	9·08	1·57	0·45	82·26	
45	Kibos, Government Farm ...	7·14	8·07	0·84	7·50	4·67	6·48	1·60	1·54	3·16	2·76	2·20	0·44	46·42	
41	Kibwezi, J. T. Morgans ..	4·74	0·73	7·12	4·95	1·91	1·76	0·00	0·10	0·00	0·00	3·40	0·55	25·26	
28	Kakamega, R. C. Mission Kisumu	5·17	8·87	0·34	15·19	14·27	3·87	2·23	8·81	15·96	6·60	0·54	0·66	82·51	
46	Kikuyu, Church of Scotland Mission ..	5·86	4·77	8·33	19·01	8·51	5·62	0·47	2·99	1·02	2·94	0·61	—	60·13	11 months
39	Kinangop, Forest Station, Naivasha	2·88	8·53	5·63	9·06	6·82	6·23	5·01	6·27	7·24	9·38	1·48	0·31	68·84	
43	Kipini, D. C.	0·63	0·56	0·95	5·31	10·84	1·08	2·52	0·62	0·26	0·00	2·45	0·00	25·22	
44	Kisii, D. C.	6·77	8·27	3·01	10·97	9·91	9·53	1·69	4·75	10·11	10·78	5·09	0·87	81·75	
40	Kismayu, D. C.	0·00	0·00	0·00	3·75	5·61	1·27	3·60	0·37	0·07	0·35	0·00	0·00	15·02	
47	Kisumu, P. C.	4·82	5·20	1·81	8·20	6·39	6·93	0·78	6·62	2·77	2·30	0·49	0·09	46·40	
49	Kitui, D. C.	5·05	1·08	8·37	11·44	3·43	0·00	0·00	0·19	0·00	0·02	5·68	0·05	35·31	
50	Kiu Station, Uganda Railway ...	3·87	2·13	3·70	6·33	2·40	3·90	0·00	0·00	0·53	0·00	0·42	0·00	23·28	
29	Kwale, Forest Station Mombasa	2·50	1·45	0·10	8·77	3·71	0·74	0·95	0·67	—	0·00	3·23	1·60	23·72	11 months
36	Kyambu, D. C.	6·41	5·81	7·28	13·45	6·82	5·58	1·49	2·35	0·75	3·20	2·02	0·00	55·16	
30	Kyambu, Kamiti Downs, Cullis Relly	4·04	5·48	7·29	14·97	4·75	6·06	1·49	1·99	0·40	2·08	2·01	0·00	50·56	
153	Kyambu, Kijambu, H. F. Wells .	5·86	5·73	9·30	16·56	8·03	5·17	2·15	2·78	0·90	3·89	1·32	0·25	61·94	
24	Kyambu, Karumu Kamunyu Syndicate	5·46	3·59	9·33	20·70	8·12	6·25	1·55	2·58	0·79	3·79	1·46	0·41	64·03	
18	Kenani Station, Uganda Rly. ...	10·23	1·91	8·49	13·70	0·00	0·00	0·00	0·00	0·00	0·00	1·44	0·53	36·30	
14	Kilindini, Uganda Railway ..	5·70	1·79	0·68	13·00	5·76	1·66	1·15	1·94	0·39	0·64	1·83	0·37	34·91	
178	Kyambu, Kittanoe, H. E. H. Caine	4·37	3·76	4·88	14·42	7·58	6·66	1·01	2·09	0·60	2·49	1·58	0·07	49·51	
52	Lamu, D. C.	1·09	0·00	0·00	11·65	19·61	0·29	2·93	1·21	0·02	0·00	0·00	0·00	36·80	
51	Lari Forest Station, Escarpment .	6·79	11·52	10·52	21·99	17·96	3·79	3·69	4·40	1·69	3·18	2·19	0·03	87·75	
53	Limoru, Caineville, W. H. Caine...	6·03	5·81	9·61	24·30	12·07	3·95	0·84	3·02	1·80	3·45	1·24	0·05	72·17	
54	Limoru, Cloverdale, B. Conybeare	—	—	9·55	18·20	13·83	5·26	0·66	2·28	1·83	3·86	1·05	0·08	56·60	10 months
55	Limoru, Hope Farm, A. D. Impey	5·11	5·96	9·38	22·46	9·39	4·97	0·99	3·25	1·79	2·53	3·41	0·21	69·45	

Rainfall Records, B. E. A. 1917.—(*Contd.*)

No.	Station and Observer.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total.	Remarks.
86	Muhoroni, B. F. Webb Songhor ...	1·42	6·15	1·51	11·89	6·27	5·30	1·35	8·91	3·23	6·63	3·31	0·16	56·13	
152	Muhoroni, Koru Farm 1450, C. Harvey	2·27	4·52	3·19	8·95	9·04	4·32	1·96	11·30	3·54	7·52	1·50	0·07	58·18	
81	Mumias, D. C.	4·66	9·89	2·62	14·37	13·46	4·21	2·87	6·39	14·40	9·78	2·08	2·27	87·00	
84	Magadi Junction, Uganda Rly ...	2·70	4·70	5·90	6·70	3·60	3·30	0·00	0·00	0·00	0·60	3·00	0·00	30·50	
91	Nairobi, Agricultural Dept. ...	4·40	5·42	7·28	15·42	4·18	6·94	0·85	2·51	1·19	2·88	1·51	0·02	52·60	
94	Nairobi P. W. D.	3·13	4·76	7·75	10·40	4·38	5·58	1·10	2·11	0·94	2·53	1·19	0·00	43·87	
93	Nairobi Hill, T. A. Wood ...	3·76	6·07	7·38	14·21	4·80	6·04	1·17	2·59	1·97	2·32	1·12	0·01	51·44	
98	Naivasha, Rustenbug, J. Barry ...	1·10	2·09	3·65	9·82	7·83	6·89	3·67	5·92	4·80	1·48	0·00	0·35	47·60	
104	Naivasha, Njabini, Capt. Fey ...	4·71	4·68	8·05	12·71	12·43	6·99	3·96	11·56	10·96	7·04	2·02	0·66	85·77	
95	Naivasha, Uganda Railway ...	2·20	2·88	4·10	6·51	4·80	2·66	3·45	6·02	2·64	2·86	1·18	0·15	39·45	
68	Narok, D. C.	9·44	5·23	4·40	8·59	2·39	5·92	1·74	1·97	0·51	2·17	1·50	0·00	43·86	
99	Nakuru, D. C.	1·92	2·52	1·66	8·09	6·94	5·56	7·11	10·90	6·67	7·76	0·51	0·00	59·64	
101	Nakuru, L. F. Eames ...	1·79	2·97	3·04	9·20	8·77	5·01	6·25	7·11	4·69	10·50	1·32	0·00	60·65	
100	Nakuru, Uganda Railway ...	2·02	2·74	3·66	8·78	8·88	5·91	8·66	11·99	6·94	7·94	0·51	0·17	68·20	
103	Nandi Hill Songor, Agraham Bros.	2·11	6·00	4·30	16 47	8·76	9·62	3·56	8·39	7·79	—	—		67·00	9 months
102	Nandi, D. C.	2·20	7·50	3·54	15·39	8·78	12·04	4·25	13·11	10·55	7·92	1·02	0·35	86·65	
175	Nandi Border, Uasin Gishu, Elgon Estate	0·22	3·90	2·62	12·33	9·91	7·96	4·73	14·29	9·48	5·63	1·03	0·34	72·44	
174	Nandi, U. Railway Voi Plantations	1·94	1·75	1·24	4·28	0·84	0·08	0·00	0·13	0·06	0·11	2·58	0·48	13·49	
108	N'gong Bagas, D. C. ...	4·56	4·66	6·05	14·09	6·90	3·56	0·47	2·40	1·36	2·68	0·24	0·00	46·97	
109	N'gong, Swedo African Coffee Co.	7·62	4·22	7·51	16·61	5·81	7·10	0·70	2·32	3·49	3·23	0·00	0·00	58·61	
111	Njoro, D. Fawcus	2·73	1·93	1·93	8·44	7·22	5·26	4·44	10·54	9·18	10·58	1·02	0·18	63·45	
110	Northern Frontier District Archer's Post	0·45	1·17	4·47	6·28	3·77	2·51	0·36	0·24	0·00	0·56	0·97	0·00	20·78	
105	Nyeri, D. C.	2·06	5·52	3·52	11·60	14·34	3·92	1·88	2·84	0·70	3·20	1·23	1·23	52·04	
106	Nyeri, Tumu Tumu, Dr. Phelps ...	(2·95)		3·72	18 52	13·31	2·83	0·63	0·81	0·22	4·24	1·57	0·00	48·80	
172	Nyeri, Capt. O'Hagan ...	3·17	4·12	3·44	11 24	—	—	—	—	—	—	—	—	21·97	4 months
114	Port Florence, Uganda Railway ...	4·41	5·67	1·92	9·16	7·93	7·05	0·58	3·58	1·93	2·72	0·36	0·00	45·31	
116	Rabai, D. C.	1·78	0·92	1·81	9·32	6·13	1·52	1·74	2·58	0·37	0·93	7·28	1·03	35·41	

Rainfall Records, B. E. A. 1917.—(*Contd.*)

No	Station and Observer.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total.	Remarks.
117	Rongai River Nakuru, A. G. Armstrong	1·63	2·35	2·07	6·19	6·70	6·81	5·22	6·88	4·62	10·43	0·32	0·00	53·22	
179	Rongai, Forest Station ...	2·78	3·67	2·23	7·44	7·49	14·51	10·96	12·00	8·06	8·94	1·59	—	79·67	11 months
198	Rumuruti, Stock Inspector in charge			new	station			13·26	7·21	2·61	3·24	0·12	0·05	26·49	6 „
115	Ruiru Power Station, Nairobi Elec. P. & L.	4·14	5·15	4·53	8·65	2·30	2·15	0·83	1·11	0·00	2·30	1·42	0·00	32·58	
195	Songhor, Kamolet, C. G. Hervey	2·77	6·21	2·92	11·49	8·66	4·95	1·49	9·20	7·47	—	—	0·07	55·23	10 „
121	Sotik, Haslehurst and Tannahill...	7·39	7·37	4·10	6·49	5·93	3·61	3·61	6·44	6·33	9·09	3·25	0·38	63·99	
120	Sotik, Nyangoris Park, J. Morgan	4·92	6·17	7·15	10·56	—	—	—	—	—	—	—	—	28·80	4 „
123	Takaungu, D. C.	0·58	0·62	1·14	5·49	7·51	2·71	2·67	2·14	0·50	0·65	0·70	—	24·71	11 „
128	Thika Chania Bridge, J. T. Oulton	6·09	0·85	3·13	9·45	1·43	—	—	—	—	—	—	—	20·95	5 „
126	Thika, C. L. Trotter	6·58	1·84	3·28	8·81	1·37	6·30	0·00	0·24	0·00	4·40	1·92	0·00	34·74	
131	Uasin Gishu, Eldoret, D. C. ..	0·69	2·36	5·88	13·26	8·18	9·40	7·74	13·08	5·32	4·98	0·88	0·10	71·87	
132	Uasin Gishu, Farm 225 L. A. Johnson	0·72	2·09	2·58	9·78	7·03	9·55	4·21	13·22	12·37	4·11	1·52	0·00	67·18	
130	Uasin Gishu, Kampi Simba E. W. Pardoe	0·73	3·03	0·79	10·51	7·31	4·19	5·63	8·17	6·01	2·62	0·07	0·05	49·11	
133	Uasin Gishu, Farm 121, 122 Smith & Lovemore ...	1·07	2·08	2·26	13·22	10·60	7·99	5·72	14·84	11·59	5·03	1·06	0·50	75·96	
135	Uasin Gishu, Farm 128 A. G. Swinton-Home ..	1·24	1·74	1·39	14·58	7·08	12·39	6·33	13·59	12·22	4·30	0·35	0·00	75·21	
182	Uasin Gishu, P. O. Farm 40 Chas. Ridgill	0·00	3·86	5·89	12·47	6·68	7·51	4·66	8·18	7·00	7·56	0·50	0·55	64·86	
136	Ulu, Machakos, Lambert & Wilson	3·28	3·95	5·65	9·16	5·59	3·52	0·00	0·17	0·25	0·00	0·71	0·00	32·28	
138	Voi, D. C.	3·30	6·21	0·98	5·22	1·78	0·02	0·02	0·14	0·12	0·05	4·44	0·91	19·59	
139	Voi, Uganda Railway ...	2·30	2·69	0·96	4·53	1·97	0·00	0·00	0·15	0·00	0·10	4·15	0·35	17·20	
145	West Kenia, Hon. R. B. Cole ...	4·09	3·98	5·44	6·62	2·24	2·40	1·86	3·59	1·90	5·15	2·32	0·51	40·10	
142	West Kenia, Farm 1226 S. S. Bastard	3·16	2·72	2·46	4·70	1·64	1·32	2·19	6·35	0·91	2·70	1·20	0·20	29·55	
149	Yala Trading Centre	3·85	4·07	4·74	15·93	6·64	4·86	5·30	—	—	—	—	—	45·39	7 months

ANNUAL REPORT

OF THE

Chief of the Economic Plants Division

FOR THE

Financial Year

1917-1918.

The Hon. A. C. MacDonald,
Director of Agriculture,
Nairobi.

Sir,

I have the honour to submit the Annual Report on the Economic Plants Division for the Financial Year 1917-18.

I have the honour to be,
Sir,
Your obedient servant,

H. POWELL,
Chief of the Economic Plants Division.

The Chief of the Division continued to act as Manager of the Nairobi Experimental Farm, Kabete, and as Superintendent of the Kabete Reformatory from the 1st of January, 1917, to 20th August of the same year, when Mr. James Johnston again resumed charge of these establishments.

A visit was made to the Vanga District for the purpose of inspecting and advising measures in regard to the rehabilitation of the native rice shambas in the Umba River Valley. Several weeks were spent in the Kikuyu Native Reserve mostly at a place known as Mahara on the Kamiti River, where a small irrigation scheme was laid out, for the purpose of serving as an object lesson to the natives of the district, in connection with the measures taken by the Government in the encouragement of the increased growing of foodstuffs. Mr. W. MacNaughten of the Kabete Experimental Farm, assisted in the work.

A period of 2½ months of the first quarter of 1918 was spent in the Nakuru and surrounding districts in connection with the stimulation of wheat growing in the Protectorate.

As usual visits were paid to several estates in the endeavour to be of use to Settlers.

Tropical Agricultural Instructor.

Circumstances made it necessary that Mr. G. Farmer should devote his time mostly to Plant and Seed Import and Export work. He proceeded on leave just before the close of the financial year and it is understood that on the expiry of his leave his appointment in the Department ceases. Mr. Farmer was a widely experienced and painstaking officer and his services to tropical agriculture in the Protectorate has been of much value.

The Rainfall for the year under review was:—

Month. 1917	*Total Rainfall.*	*Greatest Fall.*	*Date.*	*No. of Days Rain.*
April	10.28	2.08	11th	13
May	5.85	1.11	7th	2
June	0.91	0.50	25th	2
July	0.91	0.60	24th	2
August	1.76	0.73	16th	3
September	0.00	0.00	—	Nil
October	0.86	0.78	29th	2
November	7.44	2.03	9th	11
December	0.97	0.56	26th	2
1918				
January	0.48	0.34	9th	2
February	0.00	0.00	—	Nil
March	0.00	0.00	—	Nil
	29.46	2.08	April 11th	51

The Rainfall for the previous financial year 1916-17 was:—

Month. 1916	*Total Rainfall.*	*Greatest Fall.*	*Date.*	*No. of Days Rain.*
April	9.18	1.58	14th	10
May	4.86	1.22	6th	6
June	2.47	1.14	28th	3
July	2.02	0.42	6th	8
August	1.56	0.40	29th	7
September	1.46	0.70	20th	4
October	2.22	1.17	2nd	5
November	1.47	1.14	26th	3
December	6.01	2.20	3rd	7
1917				
January	1.74	0.65	18th	5
February	1.87	1.16	24th	2
March	3.23	2.50	31st	2
			March	
	38.29	2.50	31st	62

The table given below shews the rainfall returns recorded at Mazeras farm for the past 9 years, viz:—from 1st April, 1909 to 31st March, 1918.

It will be seen that the rainfall for the financial year under report is less by 2.68 inches than that for the next lowest record viz:—1913-14, when 32.14 inches fell.

The severity of the drought experienced during the last four months of the year 1917-18 is evidenced by the fact that only 1.11 inches fell, whereas in the similar period for 1916-17 the fall was 12.85 inches.

RAINFALL RETURN.

From	*Total Rainfall for year.*	*Greatest Fall.*	*Date.*	*No. of Days Rain.*
April 1909 to March 1910	54.76	1.20	19th April	127
April 1910 to March 1911	32.73	1.12	21st May	131
April 1911 to March 1912	44.58	4.15	14th May	92
April 1912 to March 1913	37.47	2.76	13th April	100
April 1913 to March 1914	32.14	2.22	29th April	90
April 1914 to March 1915	37.86	2.40	27th April	81
April 1915 to March 1916	56.74	3.77	21st May	96
April 1916 to March 1917	38.08	1.58	14th April	63
April 1917 to March 1918	29.46	2.08	11th April	51

Correspondence.

This was heavier than usual owing to the Chief of the Economic Plants Division having to deal with the correspondence relating to the Kabete Farm and Deformatory; Rice growing, Wheat stimulation and reports on various subjects. The general memoranda in regard to his own special division was also considerable.

The correspondence generally was dealt with as expeditiously as possible taking into consideration the importance of giving due attention to the carrying out of the practical and technical duties entrusted to him.

Water Supply.

In normal years of rainfall the supply of water on the farm is about equal to its requirements, but in such a period of drought as that experienced during the last four months of the financial year under notice, the amount of water available was much less than was needed; fortunately it was possible to make arrangements with the Railway Authorities to obtain water on reasonable payment from the Railway tanks adjoining, which considerably helped to tide over the difficulty.

Labour.

This was ample for the needs of the farm, taking into consideration that funds were not available for extension of the cultivated area. Owing to famine prospects the natives of the district evinced a desire for employment to a much greater extent than in years of plenty.

Nursery Work.

Owing to the failure, to a large extent, of the short rains in 1917 and the resulting shortage of water during the subsequent lengthy and severe drought, the propagation of plants was rendered much more difficult than usual, and consequently the stock of plants was considerably less than the demand.

The plants and produce consisted of:—

(*A*) *Economic Plants.*

675	Suckers	Smooth Cayenne Pineapple.
290	,,	Queen Pineapple.
20	,,	Native Variety Pineapple.
48	,,	Guindy Banana.
31	,,	Red Banana.
14	,,	Dwarf Banana.
79	Plants	Giant Papaw.
715	,,	Dominica Lime.
10	,,	Cashew Nut.
30	,,	Mango.
115	,,	Golden Bamboo.
27	,,	Green Bamboo.
3	,,	Giant Bamboo.
3100	,,	Uba Sugar-cane.
300	,,	West Indian Cane
100	,,	Striped Ribbon Cane.
5557	Total Plants.	

(*B*) *Ornamental Flowering Trees.*

Total 90

(*C*) *Ornamental Shrubs and Creepers.*

Total 112

(*D*) *The Fruit and Produce consisted of*:—

219	Smooth Cayenne Pineapples.
55	Native Variety of Pineapples.
134	Bunches Banana.
1800	Fruits Dominica Lime.
21	Giant Papaws.
166	Fruits of Orange.
72	Sisal poles.
2	Bags Maize.
100	lbs. Seed Cotton.
90	lbs. Kapok.

FREE ISSUE OF PLANTS AND SEEDS.

Date	Name	Address	Description
20th April	Chief Forest Officer (In exchange for other plants received in former years)	Entebbe	2 Giant Bamboo 2 Golden Bamboo 2 Green Bamboo
6th June	District Commissioner (for new adminstrative Station in the Giriama Country)	Rabai	150 Smooth Cay suckers 30 Guindy Banana suckers 30 Dwarf Chinese Banana suckers 30 Changamwe Banana Suckers
8th June	Asst. District Commissioner (for the shamba around the Administrative Station)	Rabai	100 Smooth Cay suckers 100 Ripley queen Suckers
25th Nov.	Conservator of Forest (for the Arboretum Nairobi)	Nairobi	20 Giant papaw 6 Allamanda Violacea 6 Oleander, pink 6 Oleander, white 12 Antigua Heath
21st Jan.	Head Office	Nairobi	1 packet Cashew nut 1 „ Adenarthera pavonina 1 „ Cassia species
14th Feb.	Ex. Engineer (for the shamba around the water works at Changamwe)	Mombasa	24 Smooth Cayenne pineapple suckers

Sugar Cane.

Keeping in mind the importance of the establishment of a sugar industry in the Protectorate, special attention was continued to be given the subject at the farm, where in November, 1917, small trial plots of 1/10th of an acre in extent each, were laid out and planted with the following varieties—B. 147, B. 3922, B. 1528, B. 4596, Natal Uba, Striped Ribbon.

Although the season as regards rainfall has not on the whole been favourable for the growth of sugar cane, nevertheless they have done quite well and will furnish further useful data during 1918-19.

The older plots of cane continued to thrive and are proving a source of usefulness to those interested in sugar growing in the Protectorate.

Vegetable Pepsine.

Mr. Kirkham, Government Analytical Chemist, spent some days at the farm in November for the purpose of carrying out experiments in the extraction of latex from immature fruits of the Papaw, with a view to proving its suitability or otherwise, as a substitute for Rennet, for use in Cheese making.

Cigar Box Wood Tree (*Cedrela Odorata*).

The Annual Report for 1915-16 contained a reference to these newly imported trees. They continue to thrive splendidly, the largest specimen having a height of 30 feet, with a circumference a foot from the ground of 16 inches, and at four feet from the ground of 12 inches.

Kapok or Silk Cotton. (*Eriodendron Anfractuosum*).

Attention has been drawn in previous annual reports to the Kapok or Silk Cotton trees on the farm, and especially to the experiments being carried out in the pruning of the trees with the view of making it easier in the gathering of the crop. Further useful data obtained during the year shew that 200 unpruned trees yielded 2 lbs. 1½ ounces of unginned Kapok per tree, while 75 pruned trees yielded 1 lb. 5½ ounces per tree. The unpruned trees are losing some of their lower branches, while the branches on the pruned trees are increasing yearly, and thus it is expected that within a year or two the yield of the pruned trees will equal that of the unpruned ones, with the greatly added advantage in the case of the pruned trees, of easy gathering of the pods or capsules.

West African Oil Palm.

Towards the close of 1917, thirteen bags of Palm Oil seeds, amounting to 2010 lbs. were imported from the West Coast by the Department of Agriculture, for trial in various parts of the Protectorate especially the Coast belt. Owing to the drought prevailing, the distribution of the seeds was held over till the long rains of 1918, and the subject will be dealt with in the next report. It may, however, not be out of place to state here that the seeds were distriabuted over a wide area, and that a circular letter, giving full information regarding the palm and its uses, was sent to all recipients of seed. The palm is fairly common in parts of the Ramisiti and Gazi districts in the Protectorate.

Fruiting specimens of the West Africa Palm are also established at the Mazeras Experimental Farm, these having been obtained from the Royal Botanic Gardens, Kew.

First Flowering of Interesting Exotic Trees.

Of interest, botanically, is the flowering for the first time since their introduction to the Protectorate, from India in 1909, of the Cannon Ball Tree. (*Couropita Guianensis*), and the Dhak or Pulas Tree (*Butea Frondosa*). Both are strikingly handsome trees when in flower. Two specimens of the Cannon Ball tree, are to be seen at the Railway Station entrance to the farm side, and the Dhak tree is growing near the office. The fruit of the Cannon Ball tree is large and globular, resembling the round cannon ball of a bygone time. Its shell is used as a drinking vessel by the natives, in its original home, and the pulp of the fruit, when fresh is of an agreeable flavour.

With regard to the Dhak or Pulas tree, this supplies the natives of India with several articles of a useful nature. The most important of these is the red astringent juice which exudes from wounds in the bark, and which when hardened by evaporation, forms one of the brittle ruby coloured substances called "Kino," or gum Butea. Sometimes, however, it goes under the name of Bengal Kino. The bark yields a coarse fibrous material. The flowers are a bright yellow, or a deep orange-red dye; and from the seeds is obtained an oil called "Moonooga oil." Finally the lac insect (*Coccus*) frequents the Dhak tree and by its punctures in the young twigs causes the formation of the substance known as stick-lac, which is used in the manufacture of sealing-wax and in dyeing.

Experimental Stations at Mariakani and Samburu.

The permanent plots of Sisal, Kapok and Dominica Limes, at Mariakani, continued to make good progress. Sisal and Kapok at Samburu have also done well.

Public Garden, Mombasa.

The assistance rendered by Mr. Farmer during the year, enabled this garden to be kept neat and tidy at all times.

ANNUAL REPORT

ON THE

Government Experimental Farm Kibos

FOR THE YEAR ENDING

31st March, 1918.

DEPARTMENT OF AGRICULTURE,
KIBOS.

THE HON. DIRECTOR OF AGRICULTURE,
NAIROBI.

Sir,

I have the honour to submit my Annual Report on the Government Experimental Farm, Kibos and on the Agricultural Instruction work carried out for the year ending 31st March, 1918.

Staff.

With the exception of that brought about by the Native School Teacher who resigned his place during the year no changes took place on the staff.

Rainfall and Weather Conditions.

Although it has been no unusual thing to report an unfavourable distribution of the long rains, and often a failure of the short rains, this is the first occasion during the past nine or ten years when these two adverse conditions have combined together, not only to do serious damage to crops but to bring about the most serious shortage of food experienced in the Province for very many years.

The damage done to crops during the long rains was confined to the lower lying country near the Lake shore, where as a general rule much reliance is hardly ever placed on the occurence of the short rains for the purpose of planting food crops. So that when this was followed by a complete failure of the short rains in the principal food producing centres, the country was face to face with a serious situation.

There is nothing important to report either as regards hail-storms, highwinds or thunderstorms.

The following is a table showing the rainfall from April 1917 to March 1918.

Month	Quantity in inches	No. of days on which rain fell	Date	Greatest fall In inches.
April	7.53	15	10th	1.25
May	4.89	12	23rd	0.90
June	6.48	8	11th	2.80
July	1.10	4	5th	0.78
August	1.54	4	31st	0.80
September	3.16	10	2nd	1.00
October	2.76	11	21st	0.50
November	2.20	2	2nd	1.70
December	0.44	2	15th	0.18
January	0.12	2	8th	0.8
February	0.70	1	28th	0.70
March	0.66	2	11th	0.40
Totals	31.58	73		

Crop Experiments.

The area put under crops of one kind or another during the year was slightly larger than the previous year, though for reasons given under the preceding head, the results of the trials especially with the short crops were perhaps the worst recorded at Kibos for ten years. The failures recorded, however, were not without their value in helping to solve the various problems which must be faced when engaged in trying to grow a diversity of crops under a diversity of weather and climatic conditions. One thing which has been clearly demonstrated and which it is gratifying to note is being more widely appreciated, as is evidenced by the rapid increase of the number of European ploughs, is the importance of thoroughly preparing the soil before planting.

The principal crops were:—Beans, Chillies, Cotton, Ground-nuts, Maize, Rice, Sugar-cane and Tobacco.

Beans.

Owing to the uncertainty of the short rains which is the recognised season for sowing beans in most parts of the province it was decided to conduct trials both towards the end of the long rains and at the commencement of the short rains. Accordingly sowings were made with the following varieties in June and July and again in September and October:—Canadian Wonder, White Haricot and Rose Cocos.

The Canadian Wonder did not come up to standard whilst the Rose Cocos were a complete failure. The White Harricot enjoying a better chance than the others, did best. The shortage of food in the country, and the consequent high prices beans are fetching, have been the cause for closer attention being given to this crop, with the result that at the time of writing well over one hundred acres are under the Canadian variety at Kibos, where the largest acreage recorded before was fifty.

The following is a table of results:—

Variety.	*Area acres.*	*Planted.*	*Reaped.*	*Average yield per acre.*
Canadian Wonder	2	26th June	2nd Oct.	717 lbs.
Rose Cocos	½	12th Oct.	8th Jan.	60 lbs.
White Haricot	2	12th June	18th Sept.	800 lbs.

Chillies.

The trials with chillies included the same varieties as heretofore. No apparent difference having been observed between the two varieties of small chillies described in previous reports as Jinja and Nyasaland chillies, the conclusion was arrived at that this was one and the same chillie described under different names. Accordingly these were planted as one experiment under the name Jinja. At the time of writing the crop which received a severe check during the year from the prolonged drought is being harvested. In view of the high prices these chillies fetch, it is surprising that their cultivation has not received closer attention in the district, where it should prove a great value as a catch crop for growing between fruit trees or similar permanent crops.

The long Mombasa variety of chillie has practically disappeared from Kibos where at one time it was very extensively grown. This disappearance is due to the increased area put under sugar-cane which is gradually threatening to supercede all other crops at Kibos.

The results with the experiment with chillies at the farm were not so satisfactory as in previous years.

The following is a table of results:—

Variety	*Area acres.*	*Planted.*	*Reaped.*	*Average yield per acre.*
Mombasa	1	April 20th	Aug. 2nd	217 lbs.
Jinja	½	May 12th	Oct.	Harvesting proceeding.

Cotton.

Since the outbreak of war interest in cotton cultivated by the natives has gradually been on the wane, especially in the Kisumu district where at one time it disappeared altogether.

As a result of a special scheme of roadside planting which was organised by Mr. Pedraza, Assistant District Commissioner, Kisumu, arrangements were made to put in a series of 2 acre plots along the Kisumu-Nyakatch road. Some 65 such plots were planted, but owing to the flooding of the Kibigori River as well as the rising of the waters of the Lake, fully 30% of the cotton planted was destroyed. This was unfortunate as the difficulties experienced in interesting the natives who have a genuine dislike for the crop, is likely to be further increased when no monetary return is obtained for the labour they may have spent on the crop. In those parts where the crops arrived at maturity a return of between 250 lbs. and 300 lbs., of seed cotton was obtained. The experiment at the farm was smaller than heretofore and was planted as late as the end of June. The distance which has been found best in normal years to plant at Kibos is 5 feet by 2 feet.

The following is a table of results:—

Variety	*Area acres.*	*Planted.*	*Reaped.*	*Average yield per acre.*
American Upland	2	June 20th	January 7th	lbs. 450

Groundnuts.

No actual plantings of this crop were carried out, but the plants which sprung up spontaneously after the reaping of the previous year's crop were carefully tended and a small crop—about 4 bags of unshelled nuts were reaped towards the end of the year.

Maize.

Both on the farm and out in the Reserve a much larger acreage was put under maize during the year. Just as this acreage was the largest for the past ten years, so also was the yield on the farm the lowest recorded during that period. This again was due to too much rain at a critical stage of the growth of the crop.

So as to be consistent with the advice given to the natives to discontinue the cultivation of the yellow maize in favour of the white varieties, only one variety, viz: Hickory King was planted on the farm. The scheme of planting referred to above provided for the planting of some 250 acres in the Kano and Nyakatch locations. It is estimated that as a result of these efforts upwards of one hundred tons of Hickory King maize were produced in the locations above-mentioned. This seems a creditable effort seeing that this is the first organised effort made to grow this variety of maize on an extensive scale in those parts of the district mentioned above.

Towards the end of the year a small quantity of seed of the Hickory King and the Horsetooth variety imported from South Africa was received from the Head Office, Nairobi. This seed has already been planted and at the time of writing is doing well, though the Horsetooth variety appears to be a very much more vigorous growing maize than the Hickory King.

The following is a table of results:—

Variety.	*Area acres.*	*Planted.*	*Reaped.*	*Average yield per acre. lbs.*
Hickory King	10	March & April	August	1,000

Upland Rice.

During the past two seasons this experiment has been a failure. Although unlike the lowland varieties these rices could be successfully grown in normal years without the aid of irrigation, any lengthy break in the rains is often fatal to the crop. Thus in normal years as many as seven bags of paddy per acre have been produced at the farm, whilst in bad years this has gone down to less than one bag. At the time of writing arrangements are in hand for putting under large areas in the district with Swamp rice imported from India and Madagascar.

This year the experiment promised quite well right up to the "earing" stage, when owing to the absence of rain the panickles failed to develop seed with the result that more than 75 per cent of the seed heads were empty.

The experiment which was three acres in extent was planted in March and April, two bags of paddy having been reaped in August.

Sugar Cane.

It is no exaggeration to say that sugar cane growing at the present time promises to eclipse if not to supercede all other crops at Kibos. This crop which appears eminently suited to the conditions at Kibos has been gaining more and more popularity during recent years at Kibos, where the manufacture of Jaggery as stated in previous reports has now become one of the staple industries.

A series of variety experiments were started on the farm some 18 months ago with the following varieties:—

1. Seedling variety No. B. 1528, a purple cane.
2. Sealy seedling, a yellow cane.
3. B. No. 3922, a yellow cane.
4. Uba or Natal cane, a yellow cane.

Although the experiment was carried out under very adverse circumstances the following points were observed. As regards vigour of growth, Sealy Seedling stood out among the others, B. No. 3922 and Uba divided the honours for second place in this respect between them whilst B. No. 1528 was a distinctly slower grower in this experiment. As only 15 to 20 cuttings of Seedling varieties were planted in the first instance, arrangements have been made to utilize all the canes from this first trial for extending the experiment next season.

Tobacco.

This crop was badly damaged by standing water, which caused the premature yellowing of the leaves in the field, the percentage of mildew was also higher than heretofore.

As has been pointed out the chances for producing the finer types of tobacco at Kibos are very poor, but there seems every possibility of producing a class of Tobacco suitable for the cheaper class of cigarettes often seen in the Kisumu markets and said to be the product of Muanza in what was once German East Africa. The curing of the leaves was carried out as heretofore in a mud and grass hut but owing to the small quantity of leaves much difficulty was experienced in curing them to the desired light brown colour.

At the time of writing the crop is still in the fermenting piles having been rearranged five times during the past 3 months.

PERMANENT CROPS.

Coffee.

This experiment despite various adverse conditions such as abnormal rains alternating with leaf disease and drought continues to attract attention.

Special attention was given to the matter of pruning and topping the trees which appear to have had a decidedly beneficial effect on them. Leaf disease made its appearance in a mild form during the year but this was soon got under control. At the time of writing both the older and younger trees are carrying a fairly heavy crop of berries, but owing to the severe drought experienced there will be a very high percentage of very small berries and light coffee.

The thinning out of the berries is being resorted to as a means towards assisting the normal development of those remaining on the trees.

FRUIT AND TIMBER TREES.

Citrus.

One of the 4 remaining budded orange trees imported from South Africa and which had produced a fairly heavy crop on the previous fruiting season withered up during the dry weather. As there was no apparent signs of disease on the trees, this was put down to the effects of the drought, and the tree cut down to within a few inches of the ground at which the plant was still green. A fresh shoot has already sprung up which it is hoped will in time develop into a normal tree.

With the exception of 2 of the young grafted trees whose growth appears to have been arrested by the attack of a fungus disease, all the plants made good growth.

The citrus brown scale was much in evidence but was more or less confined to the imported lemons. The immunity of the ordinary rough lemon from the attacks of any kind is worthy of mention. Large numbers of Seedlings are being raised for providing stock for budding later.

Cashew.

The three plants in the fruit plot have now become fully established and produced a good crop of fruits which are a great favourite with Indian children during the year.

Coconuts.

The old trees produced a few fruits which, due no doubt to the drought were rather undersized. The young plants planted to form an avenue along the fruit plot walk are doing well.

Mangoes.

All the young trees produced a small crop for the first time the Embe Dodo variety still continue to be the favourite, and the demand for young plants of this variety is on the increase. It is hoped that later it will be found possible to introduce some of the choiser grafted varieties on this farm such as has been done at Mazeras.

Papaws.

Fresh plantings of young plants raised from seed received from Mazeras were carried out. Whilst this fruit retains its excellent flavour it has a marked tendency to deteriorate in size This has necessitated the keeping of fresh nursery stocks always on hand for planting.

Pine Apples.

A further slight extension was made to the pinery during the year, the variety used for the purpose being the large Smooth Cayenne. The other varieties consisting of Frogmore, Queen and the Mombasa still continue to do well. The effects of the unfavourable weather left its mark on the size of the fruits of the varieties which was smaller than in the previous year.

Other Fruits.

The other fruits of importance which produced good crops were Bananas and Pommegranates. The new Banana plot planted on the South of the fruit plot is fast becoming established.

Timber Trees.

All the Black Wattle trees were taken out from the timber plot and the poles utilized for farm buildings. The space thus made vacant was again planted out with Eucalyptus and Grevillea robusta.

Both for purposes of demonstration as well as a source for the supply of timber so necessary in connection with all farm work, the timber plot has already proved a valuable asset to the farm, and it is proposed to undertake more extended planting of trees next year on the farm.

Labour.

The supply of labour continues good and there was a marked increase in the number of boys who came to the farm in search of work.

Live Stock.

These continue in good condition. One animal died from an abcess in the throat. There were two outbreaks of Rinderpest during the year but neither of these affected the oxen on the farm.

Visitors.

Official visits were paid to the farm by the Chief of the Economic Plants Division, also by various Administrative Officers including the District Commissioners of Kisii and Kisumu.

Distribution of Plants, Seeds, Etc.

The usual distributions of seeds to natives were carried out in accordance with arrangements made, whereby an equal quantity of seed is returned by each recipient for further distribution in other parts of the district. This year, however, owing to the failure of the crops in most parts of the districts where distribution of seed was carried out it is not expected that the natives will be in position to meet their obligation in this respect. Towards the end of the year there were more applications made by the natives for seed of various food crops than had been received at any time before.

The following is a list of seed plants, etc., distributed to the natives and to the various districts in the Province for planting during the year:—

Banana suckers	...	317
Cane plants	...	400
Lime plants	...	12
Rough Lemon plants	...	22
Giant Papaw plants	...	12
Upland Rice seed	...	110 lbs.
Chillie seeds	...	120 lbs.
Swamp Rice seed	...	15 lbs.
Beans	...	312 lbs.
Maize—Hickory King	...	3 tons.
Assorted timber trees	...	111
Assorted timber tree seeds	...	½ lb.
Cuttings of Hedge plants	...	610

Agricultural Instruction Work.

This work included as heretofore a number of visits to various parts of the Province inspecting the native as well as the introduced crops being grown by the natives, and giving advice regarding their general care and treatment.

During the year Cotton and Maize as well as other food crops received special attention. A considerable portion of the writer's time was also spent in supervising and directing work in connection with the newly laid down shamba, which was being established with the object of providing a supply of green food for the inmates of the Carrier Corps Hospital, Kisumu.

Agricultural School.

Work in connection with the above school continued on the same lines as in the previous year. The greater portion of the time of the pupils being devoted to general farm operations. Boys showing any tendency to become expert at any special branch of work were selected and as far as possible given the chance to qualify in that special branch. Thus there will be found boys who devote more of their time to such operations as ploughing, pruing and general coffee cultivation, nursery work, etc., etc. A separate report putting forth the general objects and aims of

the school was recently submitted to the Hon. The Director of Agriculture. Though of a somewhat slow nature the progress recorded since the establishment of the school might well be considered substantial, and it is hoped that, following the appointment of a Native School Teacher to take charge of the class room work, more general progress will be recorded.

I have the honour to be,

Sir,

Your obedient servant,

H. H. HOLDER,

Plant Instructor.

ANNUAL REPORT

ON THE

DIVISION OF ENTOMOLOGY.

FOR THE

Year ending 31st March, 1918.

Kabete,
April 1918.

To the Honourable,
The Director of Agriculture,
Nairobi.

Sir,

I have the honour to submit herewith my report on the work of the Entomological Laboratory for the year ending March 31st, 1918.

The work of the Division has comprised the following:—

1. Investigations on the following:—
   - (*a*) Insects injurious to Coffee.
   - (*b*) Insects injurious to Citrus.
   - (*c*) Insects injurious to Garden Produce.
   - (*d*) Insects injurious to Stored Grain.
   - (*e*) Insects affecting the Household and Public Health.
   - (*f*) Insects affecting Domestic Animals.
2. The introduction and cultivation of Silk.
   - (*a*) Eri Silk.
   - (*b*) Mulberry Silk.
   - (*c*) Indigenous Silks.
3. The inspection and fumigation of imported plants and seeds.
4. The continuance of the Coconut Beetle traps.

5. The Beginning of an Entomological Survey of the Protectorate.

6. The Maintenance of the Collection of Insects.

7. The Control of injurious Insects by Natural Parasites.

8. The Exploitation of the Natural Products of the Protectorate with a view to utilising these as Insecticides.

9. Miscellaneous.

10. Farm Inspection.

Special work has been done on the following:—

The Coffee Bug.
Red Scale.
Eri Silk.
Mulberry Silk.

I have the honour to be,
Sir,
Your obedient servant,

THOS. J. ANDERSON,
Entomologist.

INSECTS INJURIOUS TO COFFEE.

Antestia lineaticollis, Stal. The Coffee Bug.
Order, *Hemiptera* . . . . Family, *Pentatomidae.*

Introduction.

The species of Hemiptera which are recorded as serious pests on coffee are not very numerous and, with the exception of the coffee bug or, as it is sometimes called, the "variegated bug", are not difficult to control if taken in time.

The coffee bug, however, is not so easily dealt with and, up to the present, hand-picking of the bugs and egg clusters is the control method which has proved most effective.

Details of some of the experiments conducted with other methods will be found under the various headings.

It has several times been stated by planters that, in their opinion, the bug has been introduced. This, however, they cannot prove and all the evidence goes to show that it was here before the start of the coffee industry, in fact, that it is indigenous to this part of Africa. In this connection, it is strange that the original food plant or plants have not been determined. The only plants, other than coffee, from which it has been definitely recorded are the native grains wimbi and matama.

Whatever the original host plants were, it has transferred its affections to coffee and, owing to the fact that the acreage under coffee has been increased rapidly, the balance of nature has been upset and the bug has gradually increased in numbers until we have the conditions which obtain today.

The history of the introduction of coffee, moreover, provides additional evidence to the fact that it was not introduced. Seed *only* was originally brought to the country and that from Aden where the bug is unknown.

Some years ago, Mr. W. J. Dawson, took considerable trouble to find out when and how the first coffee came to the Protectorate. His results contain the following:—

> "It is known that as far back as 1895, coffee was growing at the French Mission at Bura on the Teita Hills but perhaps the plant was first introduced by Mr. John Paterson on behalf of the Scotch Mission in the year 1893. The seed was obtained from the agents of the British India Company at Aden. It was sown at Kibwezi and, in the year 1896, the first crop was reaped. In this year seed was sent to Fort Smith and the resulting plants planted on Dr. Boedeker's farm there. These bushes look well and robust at the present day. The coffee did extremely well at Kibwezi under irrigation but when left without regular watering, which resulted as a consequence of the Scotch Mission Station being removed to Kikuyu, the bushes soon died. The year 1896, therefore, saw coffee first introduced into a district which may be said to be a coffee country par excellence. The majority of our plantations have probably originated from seed of the "Bourbon" coffee (*Coffea arabica*) first grown at St. Austin's, Nairobi, in 1901."

I am indebted to the Rev. Father Bernhard, Father in Charge of St. Austin's Catholic Mission, Simonisdale, Nairobi, for further notes on the first introduction of coffee by the Mission Fathers.

The first seed was sent from Aden by a friend of the Mission to the Rev. Father Etienne in Zanzibar. This seed was first p'anted at the Bura Mission in 1893.

It appears that the Missionaries kept only about a thousand trees in order to have coffee for their own use and never paid great attention to it as regards observing bugs and the like so that there is no reliable information on that point though Father Bernhard states that, "I, personally, think that the trees suffered from Antestia because that bug was found in the country, as I heard from Missionaries who were at Bura then."

> "It was in 1900 that some plants were taken from Bura to the newly founded St. Austin's Mission near Nairobi. Here, then, experiments went on and a proper plantation was started and properly looked after which proved to be such a success and a great asset to the country. It is lucky for the country that St. Austin's Mission took to coffee. From books on Abyssinia, we knew that this country was very much similar to the Abyssian Province of Kaffa, where the Coffee is said to have been discovered (our variety, *Coffea arabica*) and from which Province it

had been brought over to Arabia, Aden being the chief export place of that coffee later on. The result proved how true were the conclusions from the comparison of Kaffa country with Kikuyu, our oldest plants here being eighteen years old and still sound, strong and bearing splendidly, showing no signs of exhaustion. I am of opinion that we can expect the trees to keep for about fifty years, bearing well, if properly looked after. But, of course, it remains to be proved by experience as in other countries. I said it is fortunate for the country that we got from Bura (the real Mocha coffee from Arabia), because in Bura the coffee did not last and seems to have no future there. Always after six or seven years they have to renew their little plantation, it being destroyed by the coffee borer. The soil and climate are also very different from Kikuyu which seems to be the ideal country for the *Coffea arabica*. An interesting but probably insoluble problem is the origin of the Uganda coffee as it was found at Bukoba in 1861. It probably came also from the Abyssinian province of Kaffa and having been given no care and attention, it may be a degenerate kind of the same *Coffea arabica*."

HISTORICAL.

Until recently, the bug was known as *Antesia variegata*, Thunb., var. *lineaticollis*, Stal. but Professor Schouteden has, after the examination of much material, come to the conclusion that they are quite distinct and has made *lineaticollis* a separate species. The East African coffee bug is, therefore, now known as *Antesia lineaticollis*, Stal.

This is the only species as yet recorded from the Protectorate but there are four species very much alike and it is possible that, when more material is available and when I have time to examine it, it will be found that we have more than one.

Mr. Gowdey, the Uganda Entomologist, appears to have a different species to deal with which he calls, *Antestia orbitalis*, Westw., var. *faceta*, Germ.

The four species, mentioned above, with their known distributions are:—

1. *A. falsa*, Sch. . . . Mozambique.
2. *A. lineaticollis, Stal.* . Dahomy, Mozambique.

South Africa, Nyasaland, G.E.A.

3. *A. transvaalia*, Sch. . Transvaal.
4. *A. usambarica*, Sch. . Usambara.

In India *Antestia cruciata* some time ago attained a certain notoriety as a pest on coffee which it damaged by sucking the berries. T. Bainbrigge Fletcher, Esq., Imperial Entomologist, India, writing to the Planters Chronicle in 1908, states that "It is widely distributed in Southern India and probably has a wide range of food plants as I have received it during the same month from Salem whence it was sent as damaging Jasmine plants in a garden. We also have it from Hillgrove, 5th September, 1908, on coffee; Coimbatore, in January, February and August, Madras City in February, 1907. As is the case with so many of our common Indian bugs, the early stages do not seem to have been described, nor is the exact life history known in any detail, but it is probable that the eggs are laid on leaves and twigs of the food plant and that the young bugs spend their whole life, gregariously at first, on the plant. The dates given above appear to indicate two broods in the year, the adults being found in January—March, and August—September."

In the Agricultural Journal, Cape of Good Hope, 1907, Mr. C. P. Lounsbury, the then Government Entomologist, gives the following notes on *Antestia variegata*.

> "I have recorded the insect only from the Cape and neighbouring districts in the South-West of the Colony, but it probably occurs all round the Eastern Coast and inland to the high veld. The Natal Entomologist records it in coffee plantations in Natal, and it is said to be a coffee pest of some importance in B.C.A. On the slopes of Table Mountain, it is common on the Taaibosch (*Rhus glauca*), the berries of which it appears to puncture and suck, and I have noticed it on a congeneric veld bush in other districts. Apple trees are much frequented by this insect, but although the fruit evidently gets much punctured, I have observed no more result to follow than a slight surface speck. In time to come, however, decays may spread which will enter by the wounds and cause serious injury. Next to apples, peaches seem to be the most pestered of cultivated fruits and the injury to them is more noticeable. Large numbers, rarely a whole crop, are punctured when very young, sometimes in a score of places. Gum exudes from the young fruit and may hang in a string from each spot. Often the fruit develops irregularly when much injured, becoming gnarled and lumpy, and consequently of little commercial value, although of a fair size and unimpaired flavour. Nearly mature peaches may decay when punctured."

Unfortunately, I have no publications from B.C.A. dealing with Antestia on coffee but it appears that there it was first mistaken for a lady-bird beetle and was supposed by the planters to be beneficial by destroying scale insects, until Mr. Cameron discovered that it really was a Hemipteron and a dangerous enemy to coffee.

From Rhodesia, the Government Entomologist writes, 10th October, 1917, "within the limits of this territory I only know of one species of Antestia, namely *Antestia variegata*. This

species appears to be generally distributed throughout the territory and came into prominence on our South-Eastern border through its attack upon coffee berries. Of course other species of the genus are probably included in our fauna, but not being of economic importance, have not come to my notice."

In the Public Health Department Annual Report, Zanzibar, for 1914, Dr. Aders, referring to *Antestia variegata*, records it from an unknown shrub and states that the few coffee trees on the Island have been carefully examined with negative results.

Mr. H. H. King, Government Entomologist, Sudan Government, Department of Education, writing in October last, says: "This genus (Antestia) is represented by only a single species, *Antestia cincticollis*, in the collection here. The four specimens which I possess were taken in the Lado district of Mongalla Province in 1911, but I have no record as to what they were feeding on. I have great pleasure in sending you by this mail one of these specimens and regret that I cannot at present give you further information on the subject."

In the coffee districts of the "Conquered Territory" *Antestia lineaticollis* has long been known as a serious pest on coffee and it is stated that in some plantations the bug was responsible for the loss of 75 per cent. of the crop.

In British East Africa, this insect appears to have had a wide distribution before the advent of the coffee planter. I have found it on the native grains, Wimbi and Matama, one hundred miles from any coffee.

Distribution in the Protectorate.

The following distribution comprises information supplied by planters, from our own records and from the reports of the Coffee Plant Inspector.

The bug is known to occur in the Nairobi, Kyambu, Limuru, Ruiru, Thika, Fort Hall, Ngong and Songhor areas. There are no records of its occurrence in the Solai, Nyeri, and Masongaleni districts.

Ninety-seven letters of inquiry were sent to planters in the districts of Kyambu, Limuru, Ruiru and Thika. By the end of March forty-four replies had been received, an analysis of which is given below.

The questions asked were:—

1. Is Antestia to be found at present in your plantation?
2. If so, are the numbers large or small?
3. Have you had outbreaks at any previous time?
4. Can you give the approximate dates of the beginning and end of any outbreaks?

The replies may be summarised as follows:—

A. Antestia not known ever to have been present 15

B. Antestia present now or at some previous time but no bad outbreak known to have occurred 10

C. Outbreaks of Antestia of greater or less severity at the time the reply was sent or at some previous time 19

The following extracts are taken from replies from plantations which have had outbreaks of the bug:—

Yes, we have had a small go of Antestia this year. It first showed itself about six years ago near my house and again in young coffee. My manager has acted on my instructions and put totos through the whole shamba and picked off all they could see.

I first noticed them in 1914. Am unable to state when the first outbreak began but they appeared to diminish the latter end of 1915 and during 1917 they appeared to disappear entirely. I noticed recently that they have again appeared but not in large numbers.

Numbers of the bug at present small. In reply to question 3, "Yes, for about two years." In reply to question 4, "I am not sure but think the last outbreak of importance commenced about early June 1917 and ended in October 1917."

Cannot find Antestia at present. At the beginning of 1917, March to April, while on leave from the front, I observed the effects of the presence of the insect and found a few but obviously they had been present in larger numbers previously though about what time I am unable to state as I was away all the previous year.

I had the bug in my coffee about three years ago. As soon as I discovered it I had a number of native totos to pick them off and had them destroyed. I now find again in a patch of coffee about two acres (8 years old) a lot of the bugs. I had the trees cut down to about two feet from the ground and the stumps well trimmed, the cuttings all burnt, and again put in totos to pick off what bugs were remaining. There are still a few but, by keeping totos going, I hope to get rid of the bugs. I have not noticed any on the young coffee so far.

In August 1915, I had a bad attack of Antestia on six acres which continued for several months necessitating cutting back the whole six acres, in many cases to a shoot from the ground. The trees have not properly recovered and I have lost at least two crops. Since then there have been very few bugs on the farm and only very occasionally do we see one at all.

We have noticed them mostly between the months of December to August. They have appeared to us to start increasing in the warm damp weather after the short rains and by April seem to be at their worst. About August when the ground is getting drier, they seem to gradually die out though we believe it is possible to find an odd one or two at any time. The same patch of coffee seldom appears to be attacked for two years in succession. Coffee attacked in 1914 was again attacked in 1917. We presume that this would be due to the work of the parasite. Dates of outbreaks:—December. 1914 July, 1914. about 8 acres: April 1915 about ten trees in young coffee very heavily attacked but the bugs did not spread: January—August 1917, about thirty acres attacked. At present have only noticed an occasional bug on the shamba.

Although, in most of the replies, little information could be given, it would seem that the bugs are most prevalent from January and February—July and August. In correlation with this may be taken the fact that in the Insectary, during that period, the bugs are more prolific and there is a general speeding up of all stages of the life cycle.

The Egg.

The egg is dull white in colour, covered with a fine powder which easily rubs off leaving the egg clear and glistening. This powder appears in the form of a delicate reticulation.

The egg measures roughly $\frac{3}{4}$ mm. × 1 mm. The measurement of 100 eggs, taken at random, gave the following averages:—shorter axis .87 mm.. longer axis 1.125 mm.. the longer axis being at right angles to the surface of attachment.

As the embryo develops within the egg a clear ring becomes distinct on the top, marking the place where the cap will split off when the young nymph emerges. The cap is a complete disc of the egg shell and may be completely split off or left behind, hinged on and may shut down again accurately. In some instances it fits back again so tightly that only the colour shows whether the nymphs have hatched.

When the egg is from 4 or 5 days to a week old, depending on the season, the eyes and central part of the head (tylus) of the nymph can be distinguished as darker spots shining through the cap.

The egg increases very slightly in size during its development.

The eggs are mostly laid at night though in the Insectary many were laid in the forenoon. Mr. Dry was fortunate enough to observe oviposition during the daytime. His notes include the following:—"She had already laid nine eggs when she was noticed. She laid three more and then immediately walked away. The interval, between two consecutive eggs appearing, was in each case $2\frac{1}{2}$ minutes. On appearing, the egg was covered with liquid, most of which, serving as a cement, ran to the end of the egg in contact with the glass surface upon which the eggs were laid. By the time another egg appeared, the previous one was

dry. One of the eggs was not in very close contact with the others. After this egg had been extruded, the female not only kept the end of her abdomen in contact with the egg for a few seconds but at the same time put one of her hind feet against it. The two other eggs were placed more closely in contact with the eggs already laid and the end of the abdomen alone was used in this way. The bug did not put the end of her abdomen into a new position for ovipositing until immediately before laying the egg."

The eggs are usually found in clumps of twelve though ten and eleven are quite common.

The largest number of eggs found in any one clump in the field was thirteen.

The eggs are fixed to the point of attachmnet and to one another by a gummy substance.

Place of Deposition.

The clumps of eggs are found on the under surfaces of the leaves, occasionally on the upper surface, on the berries, on the pedicels of the berries, on the stem, on dry leaves and even on stones beneath the bushes.

In the breeding cages, eggs were frequently deposited on glass, gauze and wood.

One fact which may be worth recording is that, if the boxes were covered with cheese-cloth or americani, by far the greater number of eggs were laid on the cloth: in many cases over 90%.

From 10,000 eggs, collected in the field, the following counts were made.

On the under side of the leaf	...	...	9,074
On the berry	...	...	416
On the stem	...	...	332
On the upper side of the leaf		...	106
On the stalk of the berry	...	...	72
			10,000

From this count it is evident that the favourite place for egg-laying is the under surface of the leaf.

An explanation of the fact that eggs are occasionally found on stones, etc., under the bushes might be that the female, when about to oviposit, was knocked off the bush by pickers or cultivators and deposited her eggs on the nearest thing available before climbing back again. Or it might be that she was so injured that she was unable to get back at all.

Number of Eggs deposited by a single Female.

As already pointed out, the eggs are laid in batches of a dozen but a female may deposit many such batches. Many experiments were conducted to determine the length of life of the insects and the number of eggs it was possible for any one female to lay.

The insects were kept under as nearly natural conditions as possible and were fed on green berries. As the skin of the berry dries fairly quickly, making it difficult for the bug to insert the proboscis and feed, the berries were changed regularly every two days.

The insects used in these experiments were, in nearly every case, of known parentage, having been bred in the Insectary.

Three of the most interesting results are:—

1. Lab. No. 28. A female which became adult in the Insectary was mated on the 16th November, 1917 to a male which became adult about the same time.

Number of eggs laid.	*Date.*
12	... 23-11-17
12	... 28-11-17
12	... 2-12-17
12	... 6-12-17
11	... 13-12-17
12	... 15-12-17
12	... 22-12-17
12	... 26-12-17
12	... 31-12-17
12	... 4- 1-18
12	... 8- 1-18
12	... 12- 8-18
12	... 17- 1-18
12	... 21- 1-18
12	... 25- 1-18
12	... 30- 1-18
12	... 2- 2-18
12	... 8- 2-18
12	... 11- 2-18
12	... 14- 2-18
12	... 19- 2-18
12	... 22- 2-18
12	... 27- 2-18
12	... 4- 3-18
12	... 7- 3-18
12	... 11- 3-18
12	... 15- 3-18
12	... 20- 3-18
11	... 27- 3-18
12	... 1- 4-18
12	... 5- 4-18
12	... 11- 4-18
12	... 17- 4-18
12	... 21- 4-18
12	... 28- 4-18
418	

Between the 23rd November, 1917 and the 28th of April, 1918, this female has laid 418 eggs. The eggs were, with two exceptions, deposited in batches of 12, the average interval between each egg-laying being 4—5 days.

2. Lab. No. 5. The female became adult on 9th September, 1917, she was mated with a male from the field on the 20th September, 1917. On the 24th September, 1917, this male died and another was introduced. She began to lay eggs on the 5th October, 1917, and between then and the 14th December, 1917, she had laid 89 eggs.

Her subsequent history is as follows:—

Number of eggs laid.		*Date.*
11	...	23-12-17
10	...	27-12-17
10	...	4- 1-18
10	...	11- 1-18
10	...	19- 1-18
10	...	24- 1-18
11	...	29- 1-18
10	...	4- 2-18
11	...	10- 2-18
11	...	16- 2-18
11	...	22- 2-18
10	...	1- 3-18
10	...	7- 3-18
10	...	13- 3-18
11	...	18- 3-18
Male died, another introduced	...	20- 3-18
8	...	28- 3-18
8	...	3- 4-18
8	...	18- 4-18
8	...	27- 4-18
278		

The female is still alive and egg-laying.

Lab. No. 24.

Number of eggs laid.		*Date.*
Male and female mated	...	16-11-17
12	...	27-11-17
12	...	2-12-17
12	...	6-12-17
12	...	11-12-17
12	...	14-12-17
12	...	19-12-17
12	...	24-12-17
12	...	28-12-17
12	. .	31-12-17
12	...	3- 1-18
12	...	8- 1-18
12	...	8- 1-18
12	...	13- 1-18
12	...	21- 1-18
12	...	24- 1-18
12	...	25- 1-18
12	...	28- 1-18
12	...	2- 2-18
12	...	6- 2-18
12	...	10- 2-18
12	...	14- 2-18
12	...	18- 2-18
12	...	24- 2-18
12	...	1- 3-18
12	...	7- 3-18
Male died, another introduced	...	7- 3-18
11	...	11- 3-18
12	...	15- 3-18
12	...	19- 3-18
12	...	28- 3-18
10	...	1- 4-18
12	. .	4- 4-18
12	...	9- 4-18
12	...	13- 4-18
12	...	19- 4-18
12	...	23- 4-18
405		

The original female is still alive and egg-laying.

These are three of the most interesting examples but there are many others all pointing to the fact that, with a regular food supply which in normal seasons is always available in the field, the coffee bug is very prolific and unless there were some natural check to its increase, the numbers in a very short time would be enormous.

The time which elapses between the females becoming adult, *i.e.*, after the fifth moult, and the time they begin to lay eggs varies considerably even among members of the same family (those which have hatched from the same batch of eggs).

In the examples given below the pairs were mated, *i.e.*, the male and female were put together in the same box, on the dates given. When exactly copulation took place in these instances was not determined. Pairs in cop are very common in the field but, for some reason or other, are seldom seen in the Insectary. From couples brought in from the field, in cop, it was found that the first batch of eggs were deposited five days afterwards on an average.

Some examples from the Insectary are:—

1.	Male became adult ...	22-12-17
	Female became adult ...	23-12-17
	Mated	23-12-17
	First eggs deposited ...	9- 1-18
2.	Male became adult ...	22-12-17
	Female became adult ...	24-12-17
	Mated	24-12-17
	First eggs deposited ...	17- 1-18
3.	Male became adult ...	24-12-17
	Female became adult ...	29-12-17
	Mated	29-12-17
	First eggs deposited ...	23- 1-18
4.	Male became adult ...	15- 1-18
	Female became adult ...	15- 1-18
	Mated	15- 1-18
	First eggs deposited ...	30- 1-18
5.	Male became adult ...	22- 1-18
	Female became adult ...	22- 1-18
	Mated	22- 1-18
	First eggs deposited ...	14- 2-18
6.	Male became adult ...	26- 1-18
	Female became adult ...	27- 1-18
	Mated	27- 1-18
	First eggs deposited ...	24- 2-18
7.	Male became adult ...	21- 2-18
	Female became adult ...	21- 2-18
	Mated	21- 2-18
	First eggs deposited ...	11- 3-18

Some examples from the Insectary are:—

8.	Male became adult	... 26- 2-18
	Female became adult	... 26- 2-18
	Mated ...	... 26- 2-18
	First eggs deposited	... 13- 3-18
9.	Male became adult	... 28- 2-18
	Female became adult	... 28- 2-18
	Mated ...	... 28- 2-18
	First eggs deposited	... 18- 3-18
10.	Male became adult	... 28- 2-18
	Female became adult	... 28- 2-18
	Mated ...	... 28- 2-18
	First eggs deposited	... 16- 3-18

Duration of Egg Stage.

The time between the deposition of the eggs and the hatching of the young nymphs varies with the seasons. During May—December last year (1917) it was considerably longer than between January and April of this year (1918). Differences of two to three days were observed in the case of batches of eggs laid on the same day and kept under the same conditions.

Examples illustrating the length of the egg stage:—

Eggs laid.	*Nymphs born.*	*Duration of egg stage, days.*
24- 5-17 ...	7- 6-17 ...	14
18- 7-17 ...	2- 8-17 ...	15
14- 9-17 ...	27- 9-17 ...	13
29- 9-17 ...	12-10-17 ...	13
30- 9-17 ...	13-10-17 ...	13
9-10-17 ...	19-10-17 ...	10
17- 1-18 ...	26- 1-18 ...	9
28- 2-18 ...	8- 3-18 ...	8
28- 3-18 ...	4- 4-18 ...	7
1- 4-18 ...	9- 4-18 ...	8
3- 4-18 ...	11- 4-18 ...	8
4- 4-18 ...	12- 4-18 ...	8

These examples will serve to show that, from the records we have at present, during the months January to April, the length of the egg stage is considerably shorter.

Nymphal Stages.

On hatching from the egg, the young bug is a small dark coloured insect measuring about 1/16th of an inch in length. In the course of its life it moults, or changes its skin, five times increasing in size after each moult and acquiring wings at the fifth moult.

Such a metamorphosis is generally termed "incomplete" as, except for the presence of wings and mature sexual organs, the young in all their stages resemble the adults and there is no resting stage during the development.

The casting of the skin is known as a moult or *ecdysis* and the periods between the moults are known as *instars* and during the various instars the young bugs are called nymphs.

1st Stage Nymph.

On hatching from the eggs the young nymphs are convex in form and nearly round in shape, measuring roughly 1/16th of an inch in length and slightly less in breadth.

They are black in colour except for two orange spots on the anterior edge of the dorsal surface of the abdomen; the under surface is uniformly black.

The legs and antennae are not so dark as the general body colour, being usually a dark chocolate brown.

The antennae are 4-segmented.

During the first instar the nymphs cluster on and around the eggs from which they have hatched and very seldom wander. There is a fair amount of evidence to show that they feed very little, if at all, during this period. Several clusters of eggs have hatched in small glass tubes and the nymphs have moulted for the first time without any food whatever and have afterwards completed their life cycle normally.

The length of time which elapses between the birth of the nymphs and their first moult varies considerably with the seasons and much more investigation is necessary to determine accurately the factors which are responsible for this difference. For eggs which hatched in June, July and August the average length of the first instar (28 examples) was 15.14 days; for eggs which hatched from September to January (30 examples) the average length of the first instar was 9.13 days, which is very considerably shorter.

After the times, indicated above, have elapsed the exoskeleton or skin splits down the middle of the back of the thorax and anterior part of the abdomen and the new nymph pulls itself slowly out and enters on its second instar. The time taken for this operation varies with the seasons from one to three hours.

At first the colour of the new exoskeleton is indefinite but gradually the skin hardens and the colours become recognisable.

2nd Stage Numph.

After the exoskeleton has hardened the nymphs wander actively and feed voraciously.

The second stage nymph measures roughly 3/32 of an inch long and a little over 1/16th of an inch broad.

More ornamentation is evident; the head is still inclined downwards and the eyes are more prominent; the white 'collar,' afterwards referred to in the adult, is becoming prominent; there is an orange spot evident in the median line of the anterior border of the pythorax; the two orange spots on the first dorsal segment of the abdomen are more prominent and there are two other, smaller orange spots further back on the abdomen (3rd segt.): six or seven little spots on the median line of the abdomen; the legs, especially the apical portion of the femur and the basal part of the tibia, are much lighter (orange) in colour; the first segment of the antenna is distinctly orange; the ventral surface is still uniformly black.

As with the first, the duration of the second instar varies with the seasons. During the months of July to September the average length of the second instar was 32.64 days and for the months October to February the average was 20.13 days.

3rd Stage Nymph.

In this stage the nymph is considerably larger, has more ornamentation in the way of colour, and is not convex in form. It measures just over 1/8th of an inch in length and 1/5th of an inch in breadth; the marks on the head now resemble those of the adult; besides the orange spot on the median line of the prothorax there is a white median line on the mesonotum and smaller white marks, equidistant from and on either side of, this median line; there is much more colour on the dorsum of the abdomen and the dorsal stink glands are distinctly visible; the ventral surface also now begins to show colour markings.

In the months August to October the average length of this instar was 22.50 days and for the months November to March the average duration of the instar was 15.83 days.

4th Stage Nymph.

All the colours are now more marked; the size has increased considerably; the rudiments of the wing covers are visible.

The average duration of the instar for the months August to December was 22.50 days and for the months November to March 12.96 days.

5th Stage Nymph.

This is now the full grown nymph, measuring about $\frac{1}{4}$ of an inch long and 3/16th of an inch broad; the wing pads and the scutellum are distinctly visible; the colour markings of the head and thorax resemble very closely those of the adult; the abdominal markings are larger and there are more of them; the ventral surface shows more colour.

During the months September to December the average length of this instar was 22.32 days and for the months December to April the average duration of the instar was 16.93 days.

In all the instars the ground colour is fairly constant but the orange and white markings vary considerably in size and brilliancy.

The Adult.

The size varies considerably in different specimens, even amongst those which have hatched from the same cluster of eggs. The average size is perhaps 3/10th of an inch in length, from the front of the head to the tip of the folded wings, and 3/16th of an inch across at the broadest part. Sufficient specimens, however, have not been measured to enable these figures to be given with any degree of accuracy.

The males are nearly always slightly smaller than the females.

The ground colour of the dorsal surface varies considerably, it may be black, dark brown, chestnut brown or lighter brown and any of these colours may be tinged with olive green.

The colour of the ventral surface is also variable. It is generally greenish but may be much lighter and showing hardly any green tinge at all. Sometimes it is distinctly tinged with red.

On this ground colour are lighter markings of orange and ivory white which in their size and position are fairly constant although many variations have been noted from what I have taken to be the typical form.

Head:—The central part of the head is black; the anterior, lateral marks are orange with their inner margin white; the other marks on the head are white.

Pronotum:—The middle anterior spot is orange, often bordered behind with white, and extending back to the posterior edge as a white line. On either side of this central colouration are two longitudinal white bands which extend backwards to the posterior edge but stop short of the anterior margin. On the anterior margin is a narrow white band resembling a collar going round the neck.

Scutellum:—The two basal lateral spots are orange often surrounded, on their outer margins at least, by a narrow band of white, a white line in the centre, sometimes confined to the base and at others extending nearly to the apex; the light coloured tip is sometimes orange, sometimes white, but usually a mixture of both.

Elytra or wing covers:—Shows orange markings on the outside edge at the base; white and orange marks on the corium; the membrane is usually black at the base and more transparent towards the apex.

Abdomen:—The dorsal surface of the abdomen, which is hidden by the elytra, is uniform black; the connexivum shows white marks on the posterior edges of the segments.

Legs:—Usually greenish in colour; the apex of the femur shows an orange mark and immediately posterior to this a dark brown ring; at the base of the tibia there is also a ring of orange.

Antennae:—In the adult the antennae are five segmented, in all the nymphal stages there were only four segments; the basal segment and sometimes the second are light orange in colour; the others are dark brown or black.

Habits of the Adults.

As a general rule, the adults seldom take to flight, although the wings are fully developed. When disturbed they dodge actively round the stem, leaf or berry on which they happen to be sitting. In the Insectary, when changing the food, it was very noticeable that it was comparatively difficult to remove them from the old berries on to the new. In many instances they had to be removed with a pair of forceps. They seemed to insert the claws of the tarsus into the skin of the berry and refused to budge.

They are much more active in bright sunshine than in the mornings or evenings or on dull, cloudy days. When shaken off a bush they fall to the ground and before actually reaching the ground they use their wings and fall with a distinct buzz. I have never been able to prove that an adult can fly from one bush to another, though they have had ample opportunity of doing so, even when the coffee was planted 8′ × 8′. If it is proved that they can do so, it is an additional argument for Mr. Trench's contention that coffee is planted too closely in this country.

The favourite food of the adult is the green berry; if these are not available the buds are next attacked; nourishment can also be obtained from the delicate green twigs; the leaves are the last resort; I have not been able to keep the adult bugs alive, for any length of time, on leaves (young or old) alone.

Complete Life Cycle.

No.	Eggs hatched	1st Moult	Life of first Nymph in days	2nd Moult	Life of second Nymph in days	3rd Moult	Life of third Nymph in days	4th Moult	Life of fourth Nymph in days	5th Moult	Life of fifth Nymph in days	Duration of Nymphal Stage
1.	7- 6-17	17- 6-17	10	15- 7-17	28	2- 8-17	18	27- 8-17	25	25- 9-17	29	110 days.
2.	7- 6-17	18- 6-17	11	16- 7-17	28	7- 8-17	22	29- 8-17	22	28- 9-17	30	113 ,,
3.	14- 7-17	26- 7-17	12	7- 9-17	43	29- 9-17	22	29-10-17	30	8-11-17	10	117 ,,
4.	14- 7-17	27- 7-17	13	7- 9-17	42	13-10-17	36	1-11-17	19	22-11-17	21	131 ,,
5.	14- 7-17	28- 7-17	14	18- 9-17	21	26- 9-17	8	13-10-17	17	4-11-17	22	82 ,,
6.	22- 7-17	7- 8-17	16	7- 9-17	31	26- 9-17	19	16-10-17	20	8-11-17	23	109 ,,
7.	22- 7-17	9- 8-17	18	12- 9-17	34	15-10-17	33	13-12-17	59	19- 1-18	37	181 ,,
8.	12- 7-18	2- 8-17	21	10- 9-17	39	4-10-17	24	28-10-17	24	15-11-17	18	126 ,,
9.	12- 7-18	3- 8-17	22	19- 9-17	47	14-10-17	25	8-11-17	25	26-11-17	18	137 ,,
10.	16- 7-17	29- 7-17	13	9- 8-17	11	14-10-17	66	1-11-17	18	28-11-17	27	135 ,,
11.	18- 7-17	1- 8-17	14	30- 8-17	29	22- 8-17	23	5-10-17	13	25-10-17	20	99 ,,
12.	,,	1- 8-17	14	30- 8-17	29	22- 8-17	23	10-10-17	18	1-11-17	22	106 ,,
13.	,,	2- 8-17	15	2- 9-17	31	24- 9-17	22	13-10-17	19	8-11-17	26	113 ,,
14.	,,	2- 8-17	15	2- 9-17	31	25- 9-17	23	19-10-17	24	16-11-17	28	121 ,,
15.	,,	1- 8-17	14	2- 9-17	32	18- 9-17	16	3-10-17	15	24-10-17	21	98 ,,
16.	,,	1- 8-17	14	2- 9-17	32	18- 9-17	16	3-10-17	15	29-10-17	26	103 ,,
17.	,,	2- 8-17	15	3- 9-17	32	19- 9-17	16	6-10-17	17	29-10-17	23	103 ,,
18.	,,	,,	15	4- 9-17	33	19- 9-17	15	8-10-17	19	1-11-17	24	106 ,,
19.	,,	,,	15	4- 9-17	33	22- 9-17	18	8-10-17	16	4-11-17	27	109 ,,
20.	,,	,,	15	5- 9-17	34	24- 9-17	19	15-10-17	21	4-11-17	20	109 ,,

Complete Life Cycle.—*Contd.*

No.	Eggs hatched	1st Moult	Life of first Nymph in days	2nd Moult	Life of second Nymph in days	3rd Moult	Life of third Nymph in days	4th Moult	Life of fourth Nymph in days	5th Moult	Life of fifth Nymph in days	Duration of Nymphal Stage
21.	13- 7-17	2- 8-17	15	5- 9-17	34	25- 9-17	20	15-10-17	20	4-11-17	20	109 ,,
22.	,,	,,	15	8- 9-17	37	26- 9-17	18	15-10-17	19	15-11-17	31	120 ,,
23.	,,	,,	15	9- 9-17	38	26- 9-17	17	15-10-17	19	15-11-17	31	120 ,,
24.	2- 8-17	18- 8-17	16	19- 9-17	32	6-10-17	17	27-10-17	21	15-11-17	19	105 ,,
25.	,,	,,	16	19- 9-17	32	8-10-17	19	29-10-17	21	17-11-17	19	107 ,,
26.	,,	,,	16	20- 9-17	33	9-10-17	19	4-11-17	26	17-11-17	13	107 ,,
27.	,,	19- 8-17	17	21- 9-17	33	16-10-17	25	15-11-17	30	23-11-17	8	113 ,,
28	,,	20- 8-17	18	24- 9-17	35	25-10-17	31	2-12-17	38	14-12-17	12	134 ,,

From the above table, during the months indicated, the average length of the Nymphal Stage, *i.e.*, the average number of days between the hatching from the eggs and the appearance of the adult bug, was 115.1 days.

The averages from hatching to 1st moult ... 15.14 days.
from 1st to 2nd moult ... 32.64 days.
from 2nd to 3rd moult ... 22.50 days.
from 3rd to 4th moult ... 22.50 days.
from 4th to 5th moult, adult ... 22.32 days.

Compare this with the next table.

Complete Life Cycle.—*Contd.*

No.	Eggs hatched	1st Moult	Life of first Nymph in days	2nd Moult	Life of second Nymph in days	3rd Moult	Life of third Nymph in days	4th Moult	Life of fourth Nymph in days	5th Moult	Life of fifth Nymph in days	Duration of Nymphal Stage
1.	14- 9-17	25- 9-17	10	17-10-17	22	4-11-17	18	20-11-17	16	14-12-17	24	90 days.
2.	,,	,,	10	17-10-17	22	8-11-17	22	27-11-17	19	21-12-17	24	97 ,,
3.	,,	,,	10	19-10-17	24	3-11-17	20	27-11-17	19	22-12-17	25	98 ,,
4.	,,	,,	10	19-10-17	24	15-11-17	27	2-12-17	17	25-12-17	23	101 ,,
5.	19-10-17	25-10-17	6	20-11-17	26	6-12-17	16	22-12-17	16	10- 1-18	19	83 ,,
6.	,,	,,	6	22-11-17	28	11-12-17	19	26-12-17	15	13- 3-18	18	86 ,,
7.	26- 1-18	4- 2-18	9	22- 2-18	18	7- 3-18	13	15- 3-18	8	30- 3-18	15	63 ,,
8.	,,	,,	9	,,	18	,,	13	15- 3-18	8	31- 3-18	16	64 ,,
9.	,,	,,	9	,,	18	,,	13	16- 3-18	9	1- 4-18	16	65 ,,
10.	,,	,,	9	,,	18	,,	13	16- 3-18	9	2- 4-18	17	66 ,,
11.	,,	,,	9	,,	18	,,	13	18- 3-18	11	2- 4-18	15	66 ,,
12.	,,	,,	9	,,	18	,,	13	19- 3-18	12	3- 4-18	15	67 ,,
13.	,,	,,	9	,,	18	,,	13	19- 3-18	12	3- 4-18	15	67 ,,
14.	,,	,,	9	,,	18	,,	13	20- 3-18	13	4- 4-18	15	68 ,,
15.	,,	,,	9	,,	18	,,	13	20- 3-18	13	4- 4-18	15	68 ,,
16.	,,	,,	9	,,	18	8- 3-18	14	20- 3-18	12	5- 4-18	16	69 ,,
17.	,,	,,	9	,,	18	8- 3-18	14	21- 3-18	13	6- 4-18	16	70 ,,
18.	,,	,,	9	,,	18	9- 3-18	15	22- 3-18	13	7- 4-18	16	71 ,,
19.	,,	,,	9	,,	18	10- 3-18	16	22- 3-18	12	7- 4-18	16	71 ,,
20.	,,	,,	9	24- 2-18	20	10- 3-18	14	23- 3-18	13	7- 4-18	15	71 ,,

Complete Life Cycle.—(*Contd.*)

No.	Eggs hatched	1st Moult	Life of first Nymph in days	2nd Moult	Life of second Nymph in days	3rd Moult	Life of third Nymph in days	4th Moult	Life of fourth Nymph in days	5th Moult	Life of fifth Nymph in days	Duration of Nymphal Stage
21.	26- 1-18	4- 2-18	9	24- 2-18	20	10- 3-18	14	23- 3-18	13	7- 4-18	15	71 ,,
22.	,,	,,	9	,,	20	10- 3-18	14	23- 3-18	13	8- 4-18	16	72 ,,
23.	,,	,,	9	,,	20	13- 3-18	17	25- 3-18	12	9- 4-18	15	73 ,,
24.	,,	,,	9	25- 2-18	21	,,	16	25- 3-18	12	9- 4-18	15	73 ,,
25.	,,	5- 2-18	10	,,	20	,,	16	26- 3-18	13	10- 4-18	15	74 ,,
26.	,,	,,	10	,,	20	,,	16	27- 3-18	14	11- 4-18	15	75 ,,
27.	,,	,,	10	,,	20	14- 3-18	17	28- 3-18	14	12- 4-18	15	76 ,,
28.	,,	,,	10	26- 2-18	21	15- 3-18	17	28- 3-18	14	12- 4-18	15	77 ,,
29.	,,	,,	10	,,	21	16- 3-18	18	28- 3-18	12	15- 4-18	18	79 ,,
30.	,,	,,	10	,,	21	,,	18	28- 3-18	12	15- 4-18	18	79 ,,

From the above table, during the months indicated, the average length of the Nymphal Stage is 75 days.

The averages from hatching to 1st moult ... 9.13 days.
from 1st to 2nd moult ... 20.13 days.
from 2nd to 3rd moult ... 15.82 days.
from 3rd to 4th moult ... 12.96 days.
from 4th to 5th moult, adult ... 16.93 days.

Compare this with the last table.

Meteorological Returns from Kabete for the year.

	May	June	July	August	Sept.	October	Nov.	Dec.	January	Feb.	March	April
Mean Temperature	61.1	59.0	58.6	59.8	60.25	59.9	61.6	61.2	61.9	63.2	64.5	63.6
Highest Maximum	75.0	75.0	77.0	76.0	79.0	79.0	77.0	80.0	81.5	81.0	83.5	82.0
Lowest Minimum	45.0	44.0	42.0	46.0	44.0	46.0	42.5	40.0	41.0	43.0	42.0	50.0
Lowest Maximum	65.0	59.5	61.0	62.0	67.0	64.0	64.0	72.5	72.0	75.0	75.5	64.0
Highest Minimum	56.0	55.5	52.5	54.0	55.0	58.0	57.0	55.5	54.0	56.0	57.0	56.5
Rainfall in inches	7.16	4.94	0.67	2.13	1.94	5.18	1.70	0.07	0.14	0.15	0.51	9.85
Degrees of Atmospheric Humidity	90.4	99.4	96.6	96.7	97.0	98.2	99.0	64.0	58.6	64.2	73.4	88.6

Sufficient data have not yet been collected to enable any definite conclusions to be drawn with regard to the reation of Antestia to atmospheric conditions. During the year under review it would appear that the life cycle was completed in a shorter time when the day temperature was higher and the degree of atmospheric humidity relatively lower.

NATURAL ENEMIES.

The coffee bug is singularly free from the attacks of natural enemies. Birds, lizards and mantids seldom touch it on account of the decidedly offensive odour emitted from the stink glands.

The eggs are destroyed to a considerable extent by Chalcid parasites which have not been identified. Four, or perhaps five, distinct species have been found.

The female inserts her ovipositor into the egg of the bug and deposits an egg. This egg hatches and the young grub feeds on the contents of the bug egg, completes its development within the egg shell and finally breaks its way out a fully developed minute wasp.

Eggs which have been parasitised in this way are easily distinguished as, some time after the Chalcid egg has been inserted—depending on the season—they begin to turn bluish-grey in colour. This colour is invariably characteristic of parasitised eggs.

As a rule, a female parasite inserts one egg only but the same bug egg may again be parasitised by another female. There is then not enough food for the development of both grubs and it would seem that both die. A certain percentage of bug eggs do not hatch at all, though the colour may have changed, and more work is necessary to determine whether this is due to double parasitisation or to some other cause. In the Insectary among all the thousands of bug eggs dealt with none have been found to be infertile.

The cap of a parasitised egg never splits off, as described in the case of the bug, but the hole made by the emerging parasite shows a ragged edge. By these two characteristics, the colour and the hole made by the emerging insect, it is easy in the field to tell from the empty egg-shells whether the eggs have been parasitised or not.

THE PARASITES.

The two common egg parasites of Antestia, for want of scientific determination, will here be known as "A," Brown and "B," Black. I am indebted to Mr. Dry for the careful way in which he has conducted most of the experiments and for the notes he has kept.

The two species may be roughly distinguished as follows:—

"A." Abdomen brown, head and thorax black in the female: head, thorax and abdomen black in the male.

"B." Head, thorax and abdomen black in both sexes, abdomen of a different type: antennae comparatively short and clubbed in the female, comparatively longer and filiform in the male.

In all the experiments, some of the results of which are given here, the following points were strictly adhered to and notes taken.

1. Date on which the experiment was started.
2. The Antestia eggs used had been deposited in the Laboratory and kept so that there was no chance of accidental parasitisation.
3. All the parasites used were known to be virgin as they had emerged in tubes not containing any individuals of the opposite sex.
4. In the experiments with mated females, the mating was actually seen to take place, after which male and female were transferred to another tube where they remained for the rest of their life.
5. Once a parasite, male or female, had mated no other individual except its mate was allowed access to it.
6. All parasites used as parents became adult on the same day on which they were used.
7. The parasites were given no food (*cf* feeding experiments) but a pad of cotton wool was kept moist in the tube.

To determine the Length of Life of the Parasites.

The date given for the start of each experiment is to be taken to mean that, on that day, both male and female became adult and were put together.

	Lab. No.	*Date started.*	*Male died after. days.*	*Female died after. days.*
"A"	165	31-12-17	7	6
	178	1- 1-18	6	5
	202	25- 1-18	7	6
	203	25- 1-18	5	5
	204	25- 1-18	5	5
	205	25- 1-18	7	6
	206	25- 1-18	6	6
	212	6- 2-18	8	7
	213	7- 2-18	7	6
	314	7- 2-18	6	5
		Averages	6.4 days.	5.7 days.
"B"	116	12-12-17	4	4
	120	13-12-17	4	3
	137	19-12-17	2	4
	139	20-12-17	3	6
	148	24-12-17	4	4
	179	1- 1-18	5	5
	188	5- 1-18	4	3
	210	2- 2-18	4	4
	222	21- 2-18	3	3
	223	21- 2-18	3	4
		Averages	3.6	4.0

In the above experiments the insects were not fed. In another series dilute golden syrup was given as a food and it was found that the insects lived considerably longer. This was particularly noticeable in the case of "B" parasites. It is probable, therefore, that the length of life in the field, where food can be obtained from the flowers, may be longer. When fed on syrup the average length of life was 12 days in the case of "B."

LIFE CYCLE OF THE PARASITES.

"A" Brown.

In the results given in the table below the males and females were virgin. When mated, copulation took place usually within five minutes. In each case the male and female were put into a tube containing fifty fresh bug eggs.

Lab. No.	Mated	First parasites hatched	No. of days to first hatching	No. of days during which hatching continued	No. of males	Number of females	Total	No. of days to first blue eggs.
165.	31-12-17	3- 2-18	34	4	3	21	24	11
178.	1- 1-18	2- 2-18	32	5	6	12	18	10
202.	25- 1-18	26- 2-18	32	5	5	15	20	11
203.	25- 1-18	25- 2-18	31	4	5	11	16	11
204.	25- 1-18	24- 2-18	30	4	2	23	25	11
205.	25- 1-18	24- 2-18	30	10	—	34	34	11
206.	25- 1-18	25- 2-18	31	5	8	17	25	11
212	6- 2-18	9- 3-18	31	5	4	25	29	9
213.	7- 2-18	9- 3-18	30	6	6	15	21	9
214.	7- 2-18	9- 3-18	30	6	4	17	21	9
						43	190	233

In this case, the time between the mating of the parasites and the first hatching of their progeny from the bug eggs was, on an average, 31 days.

The average number of eggs parasitised by a female was 23.3, and from these hatched, on an average 4.3 males and 19.0 females.

On an average 10.3 days elapsed before the first egg lost its white colour and became blue (as already described), and 13.5 days before all had become blue.

The number of females born was greatly in excess of that of the males.

Parthenogenesis.

These Chalcids are parthenogenitic, that is to say, that females, without the intervention of a male, can deposit fertile eggs. In this case, however, all the offspring are males. In no single case under observation has a female ever been produced parthenogenetically.

Some of the results are:—

Lab. No.	Mated	Female died in days	First hatched	Days to first hatching	Days hatching continued	No. of males	No. of female	Total
103.	23-11-17	4	28-12-17	35	5	12	—	12
104.	23-11-17	5	29-12-17	36	4	16	—	16
105.	23-11-17	5	28-12-17	35	5	22	—	22
147.	23-12-17	5	24- 1-18	32	4	25	—	25
155.	26-12-17	3	28- 1-18	33	2	20	—	20
189.	6- 1-18	4	6- 2-18	31	3	16	—	16
193.	10- 1-18	6	10- 2-18	31	4	23	—	23
191.	10- 1-18	6	9- 2-18	30	3	28	—	28
198.	12- 1-18	5	9- 2-18	30	3	20	—	20
195.	10- 1-18	6	10- 2-18	31	4	24	—	24
196.	10- 1-18	5	10- 2-18	31	3	18	—	18
197.	12- 1-18	4	12- 2-18	31	1	15	—	15
211.	5- 2-18	5	6- 3-18	29	5	18	—	18
215.	7- 2-18	6	9- 3-18	30	5	36	—	36
216.	9- 2-18	5	11- 3-18	30	4	29	—	29
217.	9- 2-18	5	9- 3-18	28	7	40	—	40
218.	9- 2-18	5	10- 3-18	29	5	25	—	25
221.	20- 2-18	7	21- 3-18	29	7	24	—	24
224.	21- 2-18	6	21- 3-18	28	5	31	—	31
						442	—	442

In this case the average length of the life cycle, from mating till the appearance of the next generation, was 31.0 days.

The average number of eggs parasitised by a female was 23.2, from which hatched males only. On an average the first eggs had changed colour in 10.7 days and all had changed in 14.6 days.

LIFE CYCLE OF "B."

Black Parasite.

The same conditions obtained as have been described for the "Brown" Parasite.

Lab. No.	Mated	First parasites hatched	Number of days to first hatching	No. of days during which hatching continued	No. of males	No. of females	Total	No. of days to first blue eggs
116.	12-12-17	10- 1-18	28	2	5	4	9	10
120.	13-12-17	12- 1-18	30	2	4	3	7	12
137.	19-12-17	16- 1-18	28	—	3	5	8	9
139.	20-12-17	17- 1-18	28	3	4	1	5	9
148.	24-12-17	22- 1-18	29	1	4	2	6	10
179.	1- 1-18	30- 1-18	29	—	1	7	8	9
188.	5- 1-18	1- 2-18	27	2	9	—	9	9
210.	2- 2-18	28- 2-18	26	—	2	—	2	8
222.	21- 2-18	19- 3-18	26	1	3	6	9	8
223.	21- 2-18	18- 3-18	25	2	11	1	12	7
					46	29	75	

Here, the time between the mating of the parasites and the first hatching of the next generation was, on an average 27.6 days.

The average number of eggs parasitised by one female was 7.5, and from these hatched on an average 4.6 males and 2.9 females.

In this series the insects were not fed, compare with feeding experiments on next page.

The black parasite is more difficult to rear in the Laboratory than the brown and food seems to be more essential.

When fed on dilute golden syrup the females lived much longer and were able to parasitise nearly six times the number of eggs. The results of the feeding experiment are:—

LIFE CYCLE WHEN FED.

Lab. No.	Female emerged	Mated	Eggs given	No. of eggs given	First parasites hatched	No. of days to first hatching	No. of males	No of females	Total	Female died	Length of life of female
				(about)							
301	24-1-18	25-1-18	25-1 18	30	21-2-18	27	12	11	23	5-2-18	12 days
			4-2-18	10	28-2-18	24	4	3	7		
							16	14	30		
302	24-1-18	25-1-18	25-1-18	30	21-2-18	27	10	12	22	12-2-18	19 days
			4-2-18	10	28-2-18	24	3	1	4		
			6-2-18	10	3-3-18	25	...	3	3		
			10-2-18	10	9-3-18	27	1	1	2		
							14	17	31		
303	24-1-18	25-1-18	25-1-18	30	20 2-18	26	14	12	26	5-2-18	12 days
			4-2-18	10	2-3-18	26	8	...	8		
							22	12	34		
304	24-1-18	26-1-18	26-1-18	30	22-2-18	27	23	7	30	14-2-18	21 days
			4-2-18	10	28-2-18	24	6	...	6		
			6-2-18	10	2-3-18	24	2	2	4		
			13-2 18	10	...	...	...	...	...		
			15-2-18		12-3-18	25	1	...	1		
							32	9	41		

In this case the four females used, when fed, were able to parasitise 136 eggs or an average of 34 eggs per female, and under these conditions the average life of a female was 16 days, It is quite possible that the parasites do feed on the flowers of the coffee and that, in the field, their life may be longer and their work more effective than was found to be the case in the Laboratory experiments.

The females of the black variety are also parthenogenetic and males only are produced.

Without being fed, a female on an average, parasitised 10 eggs and the life cycle averaged 27.5 days. When fed on dilute syrup, a female parasitised on an average 15.5 eggs and the average of the life cycle was much the same as already given for the brown, under the same conditions.

Owing to pressure of other work, the other species of parasites have not been experimented with.

Value of the Parasites.

Even when the young nymph is complete in all its parts within the chorion it can be destroyed by the parasites.

Eye-spotted eggs, *i.e.*, those in which the eyes can be seen distinctly through the cap, were exposed to the parasites and became parasitised in the same way as "fresh eggs."

When eggs which do not show eye spots are parasitised the change of colour from pearly white to a blue grey is fairly sudden; one day the egg will show the typical white and the next day the typical grey.

When eye-spotted eggs are parasitised this change is much more gradual.

As the average length of the egg stage is eight to fourteen days, more work is necessary to determine whether the eggs can be parasitised up to the eighth or fourteenth day respectively or not.

I am convinced that the parasites constitute a very effective natural check on the coffee bug but so many factors have to be taken into consideration that more data are necessary and much more work will have to be done before any definite statements can be made.

It seems reasonable to suppose, however, that in a plantation the parasites, as their life cycle takes about one-third of the time taken to complete the life-cycle of the bug, will gradually get the upper hand and the number of the bugs will be very appreciably reduced. Should this be the case, there are too many parasites and not sufficient eggs for them to parasitise. Many of these parasites will naturally die and it will take some time for the numbers to increase again; in the meantime the bug will get the upper hand.

Moreover, there is a certain amount of evidence to show that super-parasitisation occurs. That is to say that one bug egg has more than one parasite egg deposited in it, in which case neither hatches and the benefit is lost. This is especially the case when the parasites are in the ascendency.

It is quite within the bounds of possibility that we could upset this natural swing of the pendulum by breeding sufficient parasites in the Insectary for distribution but this would necessitate the expenditure of more money for assistance, etc.

The following table and subsequent data will show the percentage of eggs parasitised, non-parasitised, *i.e.*, those from which nymphs hatched, and those which we have taken to be super-parasitised, *i.e.*, those from which neither nymphs not parasites hatched.

The table is a record from the small patch of coffee, about six acres, on the lower part of the Government Farm at Kabete. The eggs were collected each month and as nearly as possible during the first week of the month.

Date collected	Total number of eggs	% parasitised	% non-par	% super-par
1917.				
June 25-30	292	90.0	4.5	5.5
July 1st week	1810	90.0	5.8	3.2
August 1st week	1287	84.5	4.0	11.5
September 1st week	1109	86.4	3.9	9.7
October 1st week	1281	87.2	3.4	9.4
November 1st week	403	80.1	7.7	12.2
1918.				
January 1st week	132	98.5	0.75	0.75
February 1st week	22	100	—	—
March 1st week	10	100	—	—
April 1st week	339	93.7	0.3	6.0
May 1st week	186	82	17.0	1

During August eggs were very numerous, between the 8th and 23rd about 9,000 eggs were collected.

In the first week of December only two clusters of eggs were found from one of which parasites had already hatched, one parasite only was reared from the other cluster.

During the first week of February, one boy was in five and a half days, able to find 22 eggs and 131 bugs only. The eggs were all parasitised and the bugs were either adults or in the fourth or fifth instar.

The following are the figures for five plantations in the Kyambu District.

No. 1, April 1917.—Serious outbreak on part of the farm but hand-picking done.

August 1917.—Bugs greatly reduced in numbers, from a collection of eggs on the 28th, the following were the percentages, (1,500 eggs):—

Parasitised	85.1%
Non-parasitised	5.4%
Super-parasitised	9.5%

April 1918.—"I have seen no Antestia yet, Thrips are so bad that I think Antestia would have a hard time to live as the shamba is about sucked dry."

No. 2. Antestia has been considerably in evidence since the end of 1912, in larger numbers during the hot weather early in the year.

August 1917.—A considerable amount had been done in hand-picking the bugs; from eggs collected from the 25th to the 29th the following were the results:—

Parasitised	...	85.6%
Non-parasitised	...	7.2%
Super-parasitised	...	7.2%

Early in 1918 the bugs were again very numerous throughout the plantation and much hand-picking was done.

March 1918.—Eggs collected from the same field as before gave the following percentages:—

Parasitised	...	46.4%
Non-parasitised	...	52.0%
Super-parasitised	...	1.6%

Eggs collected from an adjoining part of the plantation gave:—

Parasitised	...	73.5%
Non-parasitised	...	20.3%
Super-parasitised	...	6.2%

No. 3. The Manager informs us that, when pruning in February 1917, he observed the bugs in moderate numbers; in May 1917, they had increased enormously; at a conservative estimate, he had hand-picked 750,000 bugs.

October 1917.—The bugs were to be found only in small numbers, and the eggs count gave:—

Parasitised	...	90.8%
Non-parasitised	...	5.7%
Super-parasitised	...	3.5%

No. 4. From information supplied by the Manager, it appears that the bug had been troublesome for the last two years: the bug had only done marked injury to the coffee quite near to belts of *Grevillea robustarom*; boys had collected bugs and eggs at frequent intervals but so far as he was able to judge the bug had neither increased or decreased during his two year's managership of the plantation. Eggs collected in December 1917 gave the following percentages:—

Parasitised	...	72.2%	(1,686 eggs).
Non-parasitised	...	17.5%	
Super-parasitised	...	10.3%	

In April 1918, the bugs had decreased considerably.

No. 5. An outbreak started in July 1917; bugs were still present in the same block in spite of hand-picking having been carried on the whole time. 923 eggs forwarded to the Laboratory on the 22nd of March, 1918, gave the following:—

Parasitised	...	92.1%
Non-parasitised	...	7.1%
Super-parasitised	...	0.8%

Damage done by Antestia.

The bug is found on all parts of the coffee bush—leaves, berries, stems and buds—and, as has already been stated, pierces with its proboscis the part attacked and sucks the juices on which it feeds.

Berry.

In a bad attack the continual sucking of the bugs hinders the growth of the berry and hence the development of the beans. The berries become more or less discoloured and, in some instances, especially when the stalks have been attacked, they shrivel and drop off.

The proboscis of the bug is relatively long and, from observations made, it is from the developing beans within the green berry that most of the food is obtained. Fine canals, showing where the proboscis has been inserted, can be found running through the tissue of the berry and reaching the beans. At these points the beans show brown marks and in badly attacked berries may be mottled in appearance and stunted in growth.

Ripe and ripening berries are seldom attacked probably because the husk of the bean has hardened considerably making it resistant to puncture.

Stem.

Hard woody parts are not attacked but young, green shoots are punctured, especially when no berries are present, and brown marks are found at the point of attack.

Buds.

Next to green berries, the developing buds are the favourite feeding places. The puncturing of the buds retards their development with the result that fewer flowers are formed and there is a corresponding reduction in the amount of fruit produced.

Sometimes when the terminal buds are punctured the shoots die back for some distance. This might mean that, not only does the bug pierce but at the same time injects something into the puncture but this point has not received much attention.

The attack on the buds results in the plant developing great numbers of adventitious buds which, later on, render pruning more necessary and difficult.

To sum up, the damage Antestia does is:—

1. The bushes present a sickly appearance, twigs may die back and there is a distinct tendency to form adventitious buds.

2. The beans are spotted and stunted, are difficult to separate, and the value of the crop is thereby reduced.

Amount of Damage.

No accurate estimate of the loss due to attacks of the bug is as yet possible. A comparison of the yield per acre from a plantation which has never had Antestia with that from a plantation that has been attacked is not reliable in estimating the loss because many other factors have to be taken into account, *e.g.*, altitude, soil, rainfall. If planters have kept records of yields before and after the advent of the bug the estimate would be more accurate but here again other factors complicate matters. Perhaps some of the planters who have suffered will find time to think it out accurately but at present I have no definite records to go on from British East Africa.

In the Usambara plantations, the loss at the beginning of the harvest was estimated at 75% of the produce but this gradually diminished so that at the last picking there was often no loss at all. One planter estimated his loss for one season at 40,000 marks and another at 15,000 marks.

ARTIFICIAL CONTROL.

The Effect of Shade.

The whole question of the effect of shade on coffee is one which still awaits investigation here. Though I have not yet had the opportunity of studying the wild Nandi coffee in its natural habitat, it is evident that it does not thrive except under shade. By shade, I do not mean the windbreaks of Grevillea which are so common in our plantations but something in the way of a canopy which will to some extent protect the bushes from the direct rays of the sun and still permit a free circulation of air.

At present, I am more concerned with the effect of shade on the more serious of the insect pests of coffee. Will shade increase on diminish their activities? If it is the case that on the wild coffee *Antestia* is not present, it would be of very great importance to find out what would happen if the bug were introduced and, I think, it is an experiment well worth trying.

Antestia is an insect which loves the sunshine and is very sluggish in the mornings and evenings and on dull days and this aspect of its relation to its environment is worthy of more study.

It was definitely stated by the Entomologist of German East Africa that the bug is lacking in shady plantations, but we have Mr. Holmberg's statement that the damage done was worst close to Grevillea. I should like to point out, however, that this Grevillea was not a shade, in the generally accepted meaning of the term, but merely a wind-break.

The opinion of many of our planters seems to be that shade is unnecessary and, as there is no properly shaded plantation in the Protectorate, no definite opinion can be expressed with regard to the effect of shade on Antestia. This also points to a further line of investigation.

Cultural Methods.

All prunings should be removed at once and burned, preferably on the day on which the pruning is done. Many clusters of eggs and bugs in all stages are found on the prunings. Also, from many observations, I have noticed that the bugs will remain on the prunings until they become so dry that no more nourishment can be obtained from them. Possibly, in two or three days, the prunings are dry and the bugs, young and old, have begun to crawl away and have regained the bushes.

It is evident, therefore, that something is gained by destroying prunings as they are cut and not allowing them, which I am sorry to say is a common practice, to lie on the ground for weeks and finally to dig them in, in the belief that the soil will benefit.

It is well known that, as with humans so it is with plants, those which are not in a good state of health suffer most from any pest or disease. On the other hand it has been argued that a coffee bush in strong, vigorous growth and covered with green berries provides a most excellent place for Antestia to develop. It does, but it must be remembered that we now know the life-history of Antestia and that the great amount of food available does not materially affect this. Moreover, the abundance of food does not attract the bug as it is very seldom that they fly from one bush to another. Those on the bush will certainly develop and multiply, controlled to some extent by the parasites, but the strong bush will yield a crop in spite of the bug.

It is otherwise with the weakling. It has very often not vitality enough to produce berries for the bugs which may be present with the result that the terminals are attacked, the juices sucked from them and from the buds and the bush suffers to a much greater extent than if it had been strong and healthy.

On this point, I have no two opinions. I should urge very strongly any practice, manuring, irrigation, proper pruning, continuous cultivation, etc., which will maintain the bushes in the very best state of health to enable them to withstand or throw off the pests and diseases which may attack them.

Collecting.

By collecting is meant the hand-picking of the bugs and egg clusters.

From India we have the following:—"As regards remedial measures, collection by hand is probably the best method, the bugs being caught in a small hand-net made of a bag of mosquito-net or muslin fastened around the mouth of a ring of bamboo or light wood secured to a short handle, or being simply shaken off the bushes into pans containing water with a thin film of oil on top."

From South Africa:—"Hand collecting into a receptacle such as a pickle bottle, with a little oil at the bottom is probably the best remedy in an orchard. I do not think any spraying measures would prove satisfactory and, unfortunately, the insect is not one which will drop readily on to a sheet spread to catch it when the tree is jarred or shaken. It is least active in the cool of the day and it is then most easily caught."

From German East Africa:—The simplest way to destroy is to gather the bugs and their eggs. Children are useful for this purpose. They are especially good at finding the clusters of eggs on the underside of the leaves. Bugs, leaves and berries with eggs are put into bottles or metal plates with water into which a spoonful of kerosene has been poured. By this method the bugs are at once killed. They can also be caught in nets if they are not too numerous; they can be shaken into cloths and umbrellas and then collected into vessels. The shaking must be done in the early mornings or on cloudy days when the bugs are less lively."

In every case when eggs are collected, they should be placed in boxes. Any sort of box will answer the purpose, with a lid which can be easily removed and a glass tube inserted into a hole on one side, the idea being that when any parasites hatch from the eggs, they will naturally go towards the light and will be found in the tube. This is removed and the parasites liberated on the bushes. Any bugs which hatch can be killed.

If this were done systematically by every planter, as a part of the ordinary plantation routine, it would obviate, to some extent at least, the necessity of establishing at Kabete a centre for the distribution of parasites. It would also be conducive to a more intelligent interest, by those most concerned, in the economic insects of the country.

Attraction to Light.

A trap was constructed, consisting of a round shallow pan eighteen inches in diameter, in the centre of which an ordinary hurricane lamp was placed. In the pan was about an inch of water with a film of oil on the surface. The glass of the lamp was ground so that it would hold colours. This was placed close to a bush on which many bugs were known to be. The number of colours has not yet been exhausted but, if the bug is attracted to light at all, its favourite colour has not been found.

Attraction to Odours.

The same remarks apply here; it has not been possible to attract the bugs to any of the smells tried.

Insecticides.

Stomach poisons:—As the bug has its mouth parts adapted for piercing and sucking, it did not seem likely that poisons sprayed on the bushes would be taken by them. However, in the Kilimanjaro plantations, the following was recommended:—

5 lbs. arsenate of lead paste.
4 lbs. coarse sugar.
50 gallons water.

This and many other variations of such poisoned baits have been tried at Kabete but without success.

Contact Sprays:—These, as the name implies, are mixtures which, coming into contact with the insect and setting up physiological changes, cause death.

It is evident that, unless the insect is thoroughly wet, the spray is useless. It is not an easy matter to spray a coffee bush so thoroughly that every bug will be reached.

Suppose that half a gallon is necessary per bush and, taking 600 bushes to the acre, on a plantation of 200 acres, 60,000 gallons would be necessary. These are outside figures as only parts of a plantation may be infested and the bushes may be small or so pruned that less than half a gallon will suffice. Again many plantations are a considerable distance from the water supply and carting has to be taken into account.

A whole series of experiments are now being conducted to test the various contact sprays and, if one is found which is both effective and reasonable in cost, and if no other control method is sufficient, planters will have to consider seriously the matter of importing power-sprayers and making provision for a convenient water supply.

Additional Remarks.

Since writing the above account of Antestia, I have had access to a copy of a publication by the Entomologist, Uganda, entitled "Some Agricultural Pests of Uganda," in which he discusses at some length the life-history and control of the Uganda coffee bug or variegated bug which he calles *Antestia orbitalis*, Westw., var. *faceta*, Germ.

How far this species differs from ours I am unable to state as I have no specimens for comparison but from Mr. Gowday's description it would appear to be quite a distinct species.

Some of the differences between his results and mine are given here. I quote his words first and then point out how our observations differ from his. It would be very interesting if it turned out that we were really dealing with the same species as then some light might be thrown on the adaptation of the insect to its environment, a study which is just as important as a thorough investigation into its life-history.

1. "The eggs are oval, about one-sixteenth of an inch long and are laid in irregular rows, from seven to thirty eggs being found in a cluster." (Page 115).

From all the records, from some thousands of clusters of eggs dealt with both from the field and from the Insectary, I have found that by far the most usual number of eggs in any one cluster is twelve, nine, ten and eleven also being common. In a very few cases only has twelve been exceeded and then thirteen was the maximum number found. As an example of this compare the table on page 15 of this report, where it will be seen that, in the case of the particular female referred to, Laboratory No. 28, of the 418 eggs which she deposited between the 23rd November, 1917 and the 28th April, 1918, with two exceptions all the eggs were laid in clusters of twelve.

Some of our females invariably had twelve while others, under the same conditions, had tens or elevens.

2. "Newly laid eggs are dull pearly white in colour becoming slate coloured or darker a few days before hatching."

This is not so with our variety. The eggs are white in colour and remain so until the hatching of the nymphs, with the exception of the eyes and tylus of the embryo which show reddish in colour through the egg-shell.

Any eggs which turn to a slate colour or to a bluish-grey are parasitised.

3. "The immature insects or nymphs, on hatching, remain in clusters around the egg-shells for several hours, after which they disperse in search of food."

I have found, in this respect, a great difference in *lineaticollis*. The young nymphs, on hatching, cluster on and around the eggs from which they have hatched and remain there without wandering until their first moult. In fact, there is a fair amount of evidence to show that they feed very little, if they feed at all, during the first instar.

We have kept many clusters on the berries until their first moult when an examination of sections of the epidermis of the berry showed not the slightest trace of punctures or of discolouration. There was nothing else for them to feed upon but the single berry on which the cluster was originally deposited. With this may be correlated the fact that the second stage nymph is a voracious feeder.

4. "The complete cycle from egg-laying to the death of the adult takes on an average one hundred days."

This is entirely different from our experience. Females, kept under as nearly natural conditions as possible, have lived and laid fertile eggs for nearly eight months and are still going strong, *e.g.*, page 47, where a part of a female's activity in this respect is indicated. Further, many females have lived in the Insectary for months. They were certainly fed every second or third day on fresh green berries but such a food supply would be available in the field. Whether they would live for so long a period under absolutely natural conditions I am unable to state as no attempt has been made to elucidate this point.

5. "The adults are very active, taking to flight readily when disturbed."

Our species is not very active on the wing and it is sometimes comparatively difficult, even in bright sunshine, to get them to let go their hold of the berries or stems. They certainly dodge actively when disturbed but I have never taken them on the wing. When they drop from a bush they open their wings and fall with a slight buzzing noise but they never attempt to fly back to the bush from which they have fallen; they invariably walk along the ground and then up the stem.

6. Mr. Gowdey has done some experiments with various contact sprays and of the Resin Wash, he says:—"This spraying mixture proved to be the most effective of all the mixtures experimented with and, in view of its effectiveness and its cost, I regard it as being the best spray to use."

His formula is:—

Caustic soda, 92%	...	4 lbs.
Resin ...	...	6 lbs.
Whale oil soap	...	10 lbs.

Powder the resin and soda, boil together in 2 gallons of water until they are dissolved. Make up slowly to 5 gallons with water while still boiling the mixture. In another vessel dissolve the whale oil soap in 5 gallons of hot water. Mix the two lots of solution and dilute to 45 gallons.

Anthores leuconotus, Pascoe. The White Coffee Borer.

As early as 1877, this beetle was noted by Kirk in Zanzibar as an enemy to coffee. Since 1894 it has been reported as one of the most serious pests on coffee in German East Africa, having been found for the first time a year earlier in the coffee of the Mission station at Morogoro.

In 1912, I found it destroying the coffee at the Bura Mission near the Voi-Taveta road, since then it has been reported from the Masongaleni area.

Distribution.

Natal, Transvaal, Cape Colony, Delagoa Bay, Zomba, Chinde, Congo, Uganda, and the Conquered Territory.

Beetle.

The general colour of the insect is umber-brown. The elytra or wing covers are brown with the basal area and a broad transverse band greyish; head and thorax brown; antennae in the male as long as the body and in the female longer than the body.

Life History.

The egg is laid on the bark near the ground level. On hatching, the young larva burrows for some time under the bark feeding on the inner layers of the bark and the cambium. The outer bark is often left intact and can be easily removed showing the work of the larva beneath. When the outer bark falls off the dry wood of the stem is exposed. In some cases the stem was completely ring-barked and the bushes died.

After a time, the larva burrows into the stem sometimes in the forks of the roots, sometimes just about the ground level and sometimes well up the stem. In one instance a bush was cut which showed no burrow into the stem below two feet from the ground although there was ample evidence that the larva had eaten its way up from the roots to this level, under the bark.

In other cases the tap root and branch roots were tunnelled.

Once the larva or larvae have entered the stem they form tunnels or galleries which sometimes extend to the branches almost completely excavating them. In many instances the main stem was so weakened that it could be broken over easily by the hand.

The length of life of the larva has not been determined but probably lasts at least two years.

The presence of the larva can be detected by the excrement and dust which is extruded and which will be found sticking out from the holes in the stem, clinging to the stem and leaves, and on the ground close to the base of the stem.

The damage may be summarised as follows:—

1. The stem may be ring-barked when no nourishment can ascend from the roots and the tree dies.

2. The stem may be partially ring-barked when the bushes suffer from a decreased food supply.

3. The stem may become so excavated that it can be broken by the wind or by workers in the plantation.

4. The tap root and roots may be tunnelled and weakened.

Control.

Larvae, when located, can be cut out with a sharp knife; the wound so caused soon heals. This is often a difficult operation as the stem is hard and thick and the cutting takes time.

A drop or two or barbon bisulphide, injected into the holes by means of some instrument like a bicycle oil can, will kill the larvae. After the injection the holes should be plugged with clay.

Apate monachus, F., the Black Coffee Borer.

This borer has been reported from several plantations and seems to be on the increase. As soon as the dust is noticed on the ground at the base of the stem, the bushes in the vicinity should be examined and prompt measures taken to prevent its spread. On one estate it was easily eradicated by the injection of a few drops of carbon bisulphide into the holes and plugging them with clay.

The females are slightly larger than the males; the head is larger and there is more ornamentation on the head and thorax; females measure about 3 cm long by 10 mm broad; males measure 2 cm long by 6.5 mm broad.

The first record of damage done by this insect was in the Antilles, in 1793, on cotton.

It is widely distributed over the world and is recorded from most parts of Africa.

In British East Africa, its host plants are coffee, citrus, and grevillea.

The stems and branches of coffee are often so weakened by the borrowing of both larvae and adults that they break over easily in the wind.

Other insects of coffee reported during the year are:—

Cutworms. In some cases the plants have been damaged at the soil level, in others the bark has been eaten, far up the terminal, by the climbing cutworm.

The Berry Moth, has been recorded from several new districts.

Stinging Caterpillars, of a species of *Parasa*, are common in some places and interfere with the picking.

Thrips has done a tremendous amount of damage, in most of the coffee growing areas, assisted materially by the prolonged drought. As far as I have observed this insect is absent from the Solai and lower Molo districts. In normal seasons, in the Kyambu and Nairobi areas, it is to be found in small numbers on every coffee bush and does very little damage but the recent abnormal seasons have provided the ideal conditions for its rapid increase.

It is now one of the subjects of investigation at the Laboratory but great difficulty is experienced in keeping the insects alive in the Insectary. Whether this is due to the affect of shade or not has not been difinitely determined. It is certainly true, however, that in a dry, sheltered atmosphere, where there is not a free circulation of air, the insects multiply rapidly, whereas when the atmosphere is damp and there is a free circulation of air, though the insects may be present in considerable numbers, they do not do the same amount of damage.

Thrips can be controlled by spraying and there are several sprays which are efficacious but, as pointed out when dealing with *Antestia*, the requisite water supply and machinery are not at the present time available.

It behoves every coffee planter to consider seriously the advisability of spending, say one hundred pounds, on a proper power spraying outfit which will be available when he is threatened with the loss of one, if not more, season's crop. I most certainly advise him to do so as it will pay in the long run. Scale insects are on the increase, and the same spraying plant will suffice to control these.

INSECTS ATTACKING CITRUS.

Icerya purchasi, Maskl., the Fluted Scale, the Cottony Cushion Scale, the Australian Bug, and in South Africa known as the Dorthesia.

This scale thrives on a variety of plants and has been recorded from most districts of the Protectorate on citrus, roses, wattle, Pittosporium, etc.

Australia seems to have been the original home of the scale whence it has spread over the world. When it was first introduced into California, about the year 1868, it spread rapidly. In 1880, the ladybird beetle, *Novius cardinalis*, was introduced and soon had the scale under control and has kept it so ever since.

It was first recorded in South Africa by Mr. Ronald Trimen in 1877, when it was called the Australian Bug, and in about ten years had become widely distributed and had a wide range of food plants.

There are no records to show when it was first introduced to British East Africa or where the plants came from.

When the female is full grown a white waxy material is secreted from numerous pores situated on the posterior and lateral edges of the underside of the body. This waxy material is a covering and protection for the numerous, orange-yellow eggs. As the sac develops, it lifts up the body so that finally the insect appears to stand on its head.

When the young larvae hatch from the eggs they settle down usually along the veins of the leaves. After the second moult, when they have grown considerably, they prefer the twigs and stems.

Unlike most other scales, the fluted scale is active and can wander about at least until the formation of the egg-sac.

The early stages of the male, which is winged, are similar to those of the female. Later on, when full grown, a waxy covering is formed within which it pupates and from which ultimately the winged male emerges.

The insects suck the juices from the leaves, branches and stems and in a bad infestation the vitality of the plant is considerably reduced. A large quantity of honey-dew is given off on which several species of fungi thrive.

The scale is protected from sprays by the waxy covering and, if natural enemies are not keeping it in check, the best method of control is to crush or pick off all those showing egg-sacs and spray or paint the affected parts with hot kerosene emulsion.

Through the kindness of Mr. C. P. Lounsbury, Entomologist to the Union of South Africa, two consignments of *cardinalis* have been despatched to Kabete. Unfortunately, on their arrival, the pupae cases were empty and only four live beetles have so far been secured.

Further attempts are being made to cultivate, for distribution, the indigenous ladybird beetle parasites of *Icerya*.

Chrysomphalus aurantii, Maskl., Red Scale.

When or how this scale was first brought into the Protectorate has not been definitely settled but in some instances it can be traced to consignments of trees from Australia.

Since its introduction, it has taken kindly to its new environment, its spread has been rapid and it is by far the worst enemy to citrus culture we have at present.

It is evident that, from the rapidity with which the scale multiplies and the amount of damage it does to the trees, any further planting on plantations where the scale at present exists will be attended with very grave risks. It is further evident that the longer the scale is allowed to multiply unmolested the more chance there is for it to spread to other plants.

FUMIGATION FOR RED SCALE.

Tents. If the trees are small an airtight box can be used but for larger trees tents are necessary.

A suitable tent is made of 8 oz. army duck and is octagonal in shape. A black line is painted across the centre (three lines 1½ feet apart are perhaps more convenient as there is less trouble in getting a line across the centre of the tree) and marked in feet each way, starting from the middle.

The size of the tent will naturally depend on the size of the trees to be treated. The Kabete tents are 32 feet across and if larger tents are required an extra piece can be sewn on round the bottom.

With a little practice, two boys with two long bamboos can have the tent in the correct position over the tree in a minute.

Amount of chemicals per tree. To determine the quantities necessary multiply the distance over by the distance round and divide the result by 100. This gives the amount of cyanide in ounces. For example, a tent is 28 feet over and measures 45 feet round, hence 28 × 45 = 1,100, divided by 100 gives 11 ounces of cyanide necessary. The proportions would be:—

Potassium cyanide	...	11 ounces, avoirdupois.
Sulphuric acid	...	11 ounces, fluid.
Water ...	...	33 ounces.

Fairly deep glazed earthenware or enamelled dishes are used. The water is put in first and the acid slowly added; the dish is then placed under the tent and the cyanide dropped in. The tree is left exposed to the gas for about one hour.

Spraying with imported concentrated lime-sulphur has given good results but owing to the poor quality of the local lime attempts to make the spray have not as yet met with much success.

Other insect enemies to Citrus reported during the year are various species of scale insects, which to some extent are controlled by natural parasites.

The Citrus Psylla, causes the unsightly swellings on the young leaves. This species is still unindentified though it has been sent home several times. It is not responsible for much damage but in a bad infestation the young trees are distorted in shape and unsightly in appearance. It has a very wide distribution in the Protectorate.

The caterpillars of *Papilio demodocus*, Esp. and *Papilio mackinnoni*, Em. Sharpe have repeatedly been forwarded for identification.

Fruit flies, *Ceratitis capitata* and a species of *Dacus* have worked considerable havoc in neglected plantations but these can be controlled by a timely application of a poisoned bait.

Leaf and flower-eating beetles have also been in evidence but have not been responsible for much damage.

Aphis taveresi and *Toxoptera aurantii* are common everywhere but are easily controlled.

If the acreage under Citrus is going to be extended, prospective growers must make adequate provision for a complete spraying outfit before they start planting so that they are in a position to tackle any enemy they have to control within its initial stages and before it has got beyond their control.

Coconut Beetle Traps.

The traps, or artificial breeding places for the coconut beetle, *Oryctes monoceros*, Oliv., which were started in 1913 have been continued. They have been opened regularly every four or five months.

The original 288 traps have been added to and there are now 350 traps, 325 on the Mainland and 25 on Mombasa Island. A further 100 traps were constructed by Mr. Dopwell at Gazi but these have now been taken over by the manager of the plantation.

As the contents of a trap shrink considerably, one or more dead palms are cut at each opening to keep the trap of the required size.

The following are the results up to the 31st March, 1918:—

Traps Nos. 1—186 *inclusive.*

Situated in the Changamwe, Jomvu, Miritini, Rabai, Mwele, Kisimani, Cha'ngombe, Mlege, Makirunge, and Mwirarani districts.

Constructed between 18th July, 1913 and 22nd November, 1913.

Each of these traps has been opened 10 times.

Last date of opening of No. 1—1st November, 1917.

Last date of opening of No. 186—31st January, 1918.

Number of dead palms cut for upkeep of traps, 2,190.

Number of beetles, etc., collected and destroyed:—

Beetles.	*Pupae.*	*Larvae.*	*Eggs.*	*Total.*
9,493 ...	4,987 ...	68,584 ...	3,105 ...	86,169

Traps Nos. 187—288 *inclusive.*

Situated in the Mwirarani, Junda and Freretown districts.

Constructed between 22nd April, 1914 and 8th June, 1914.

Each trap has been opened 9 times.

Last date of opening of No. 187—31st January, 1918.

Last date of opening of No. 288—7th March, 1918.

Number of dead palms cut for upkeep of traps—1,131.

Number of beetles, etc., collected and destroyed:—

Beetles.	*Pupae.*	*Larvae.*	*Eggs.*	*Total.*
3,829 ...	2,663 ...	26,277 ...	1,182 ...	33,951

Traps Nos. 289—300 *inclusive.*

Situated in the Freretown district.

Constructed between 22nd and 25th January, 1915.

Each trap has been opened 8 times.

Last date of opening of No. 289— 8-3-18.

Last date of opening of No. 300—11-3-18.

Number of dead palms cut for upkeep of traps—134.

Number of beetles, etc., collected and destroyed:—

Beetles.	*Pupae.*	*Larvae.*	*Eggs.*	*Total.*
462 ...	345 ...	3,058 ...	90 ...	3,955

Traps Nos. 301—308 *inclusive.*

Situated in the Freretown district.
Constructed, 30th June, 1916.
Each trap has been opened 5 times.
Last date of opening of No. 301—11-3-18.
Last date of opening of No. 308—13-3-18.
Number of dead palms cut for upkeep of traps—72.
Number of beetles, etc., collected and destroyed:—

Beetles.	*Pupae.*	*Larvae.*	*Eggs.*	*Total.*
179	100	1,012	23	1,314

Traps Nos. 309—311 *inclusive.*

Situated in the Freretown district.
Constructed, 2nd February, 1917.
Each trap has been opened 3 times.
Last date of opening, 13th March, 1918.
Number of palms cut for upkeep of traps—9.
Number of beetles, etc., collected and destroyed:—

Beetles.	*Pupae.*	*Larvae.*	*Eggs.*	*Total.*
51	25	235	—	315

Traps Nos. 1—14 *inclusive.*

Situated at English Point.
Constructed, 13th January, 1916.
Each trap has been opened 6 times.
Last date of opening of No. 1—14-3-18.
Last date of opening of No. 14—18-3-18.
Number of dead palms cut for upkeep of traps—96.
Number of beetles, etc., collected and destroyed:—

Beetles.	*Pupae.*	*Larvae.*	*Eggs.*	*Total.*
455	328	2,877	71	3,731

25 Traps on Mombasa Island.

Nos. 1—20 *inclusive.*

Constructed between 15th and 25th November, 1915.
Each trap has been opened 6 times.
Last date of opening of No. 1—25-3-18.
Last date of opening of No. 20—30-3-18.

Nos. 21, 22.

Constructed, 25th November, 1915.
Each trap has been opened 5 times.
Last date of opening, 25th October, 1917.

Nos. 23, 24.

Constructed, 11th July, 1916.
Each trap has been opened 4 times.
Last date of opening, 26th October, 1917.

No. 25.

Constructed, 14th February, 1917.

Opened twice.

Last date of opening, 26th October, 1917.

Number of dead palms cut for upkeep of traps—175.

Number of beetles, etc., collected and destroyed:—

Beetles.	*Pupae.*	*Larvae.*	*Eggs.*	*Total.*
764	520	4,762	153	6,199

In the construction of the first 288 traps 1,204 dead palms were cut and split, of these 812 were standing dead palms and 392 were lying on the ground.

The beetles, etc., collected from these and destroyed were:—

Beetles.	*Pupae.*	*Larvae.*	*Eggs.*	*Total.*
14,403	196	21,589	1,157	37,345

In the construction of the other traps the average number of dead palms cut was four, giving 248 palms cut for the 62 traps.

Hence in the construction of the 350 traps now in existence, 1,452 dead palms were cut.

Before 5th June, 1913, Mr. Dopwell had destroyed 7,656 beetles and 28,710 larvae.

From the beginning of the work, therefore, in 1913 to the 31st March, 1918, the following is the result:—

Dead Palms destroyed.	*Beetles.*	*Pupae.*	*Larvae.*	*Eggs.*	*Total.*
5,259	37,292	9,168	157,104	5,781	209,345

Labels.

Each trap has an iron label attached to it. Considerable difficulty has been experienced in keeping these intact owing to thefts and fires.

On each label is stencilled the date of construction and the last date of opening.

Complaints have, from time to time, been made that the stencilling has not been kept up to date. In this connection, may I point out, that besides the stencilling a book is kept in which are written the dates of all openings and closings and the results and a copy forwarded to me monthly. It is quite possible that, at times, the stencilling has not been kept up to date but the book has.

Two courses are open to me, either to do away with the stencilling of dates of openings altogether or to make another attempt to have the stencilling done immediately the trap is closed. This is being done at present. I deprecate the interference of outsiders in these experiments. We certainly welcome criticism but it must be constructive and not destructive.

Life History of the Beetle.

I regret that, for various reasons, the life history of the beetle has not been worked out in any detail. Mr. Dopwell, after many years experience of the Coast and coconut planting, has come to the conclusion that three or perhaps four openings a year are sufficient. That a detailed study of the life cycle of the beetle, its habits and its relation to its environment, should be undertaken is very necessary but lack of staff renders this, for the present, out of the question.

Cost of Maintenance of Traps.

With regard to the cost of maintenance, no exact estimate is possible because so many factors have to be reckoned with. When the traps are opened and refilled there is a certain amount of shrinkage which has to be met. This is usually done by cutting the dead palms in the vicinity and utilising these but it is obvious that after repeated openings and fillings this source of supply becomes exhausted and the men have to go further afield for the necessary material, thereby entailing a considerable extra expenditure of time and consequently it takes longer to do the work and the cost of upkeep gradually increases. Labour fluctuates as also does the rate of pay.

Mr. Dopwell, vide his report, does not commit himself to a definite statement but, taking all things into consideration, leaving out the original cost of construction, he estimated that it costs about Rs. 3/- per trap per annum.

Experiments at Mazeras.

Some time ago a series of experiments was arranged to be carried out at Mazeras. These, however, chiefly owing to lack of proper supervision, have come to nothing. If the coconut industry is to be fostered scientifically, I think it is time that something definite was undertaken in this respect.

Plant Import Inspection.

Mr. Farmer has acted as Plant Import Inspector during the absence of Mr. Sharpe on military duty.

During the year 270 packages, with a declared value of Rs. 18,124, have been examined and passed. These mostly consisted of vegetable and flower seeds.

I understand that Mr. Farmer, before he left the country, submitted his report direct to you.

Farm Inspection.

During the year, ninety-four farms and plantations were visited by the Staff of this Division.

Mr. Adams, June 29th to August 25th, made a tour of part of the Uasin Gishu Plateau to examine citrus for red scale.

Mr. Dry was on tour for the following periods:—

1. From September 10th to October 1st, in the Songhor, Koru and Fort Ternan areas.

The chief objects of the safari were to search for Antestia on coffee and Red Scale on citrus.

Antestia:—Four specimens only were found. These were all on one plantation. The specimens differ in certain points of colouring and marking from Kabete specimens. The only records of th coffee bug from this neighbourhood, from the reports of the Coffee Inspector, are from this farm. His remarks are "a few cases noted."

Red Scale on Citrus:—Red Scale was found on 5 plantations.

The following insects were collected by Mr. Dry from coffee:—

1. Two species of caterpillar, not yet identified, from one of which a butterfly has been reared.
2. Cutworms, insects themselves not seen, but some damage had been done in one plantation.
3. *Lagria Villosa, F.*, taken several times on coffee.
4. Borer, species incert, results only seen.
5. *Antestia*, four specimens only found, as already stated.
6. *Nezara Viridula, L.*
7. *Agonoscelis versicolor, F.*, only a few specimens found.
8. *Phymateus viridipes, Stal.*, the coffee locust.
9. *Thrips*, not in evidence but has been found on one plantation in small numbers by the Coffee Inspector.
10. *Toxoptera coffeae*, Niet., in small numbers only.
11. *Ceroplastes ceriferus*, Anderson.
12. *Lecanium africanum*, Newst.
13. *Lecanium hemisphaericum*, Targ.
15. *Lecanium hesperidum*, Linn.
16. *Pulvinaria psidii*, Mask.
17. A red, papery scale; afterwards identified as *Selenaspidis articulatus*, Morg., also found on citrus; in some instances the leaves only were attacked but in others hundreds of specimens were found on a single orange which not only rendered the fruit unsightly but had a marked effect on its development.

The following were found on citrus:—

1. *Papilio demodocus*, Esp.
2. *Pachnoda sinuata*, F.
3. *Diplognatha silicea*, Macl.
4. *Lagria villosa*, F., and other species of *Lagria*.
5. *Trioza* sp., the Citrus Psylla.
6. *Aphis taveresi*, Del Guer. common.
7. *Chrysomphalus aurantii*, Maskl., the Red Scale.
8. *Lepidosaphes beckii*, Neum.
9. *Ceroplastes ceriferus*, And.
10. *Lecanium africanum*, Newst.
11. *Lecanium hemisphaericum*, Targ.
12. *Lecanium nigrum*, Niet.
13. *Lecanium hesperidum*, Linn.
14. *Pulvinaria psidii*, Maskl.
15. *Icerya purchasi*, Maskl.
16. *Selenaspidis articulatus*, Morg., as stated above.

The oldest plantations in the area visited were started about five years ago and, up to the present, insects do not seem to have given trouble. A number of different species of scale insects were found, usually on an odd tree here and there. They were frequently noticed to be parasited and several species of parasites have been reared from the material collected.

Grasshoppers, probably of the genus *Epacromia*, were much in evidence in this district. They have been observed to move about in swarms, in various directions. Mr. Solly at Koru, thought that the general movement was from East to West. Damage was done to maize, teff-grass, and sugar-cane; possibly the wet weather of the previous year, by preventing the usual burning of the grass, had some effect on the increase of these insects.

2. In the Ruiru district, from November 9th to 13th, 1917.

The object of the visit was to search for the nests of the wild silk moth, a species of *Anaphe*.

His notes include the following:—"These nests occur in a tree which the Akikuyu call "Mukoiyo." This is a common tree near to the Ruiru river and is also found to a smaller extent on higher ground away from the river. Both banks of the river were searched, four nests being found and later one other nest on a tree at some distance from the river. The nest were from 12 to 20 feet from the ground, on the smaller branches, and were always constructed round a fork. The largest, of an oval shape, measured about five inches by four by three; the smallest about three by two by one and a half inches. Of the five, three appeared to have been parasitised, the other two appeared to contain the pupae of the moths. The smallest nest, just mentioned, contained the remains of eighteen dead caterpillars which had not pupated and some empty pupal cases of a parasite. I was told that nests considerably larger have been found, measuring in some instances twelve inches in diameter. The natives are familiar with these nests and they appear to be fairly common in this district at certain seasons."

3. Chania Bridge, December 7th and 8th, on Antestia and Red Scale work.

4. March 1st to March 17th, 1918, Limuru district, coffee plantation, in connection with a bad outbreak of Antestia.

Personally, I was away from the Laboratory for the following periods:—

June 29th to July 23rd, 1917—In the Nakuru district.

August 8th to 14th, 1917.—Mombasa.

November 13th to December 21st.—Mombasa and Voi.

February 9th to 19th, 1918.—Nakuru.

March 25th to April 6th, 1918.—Thika and Mombasa.

Treatment of Nursery Stock.

Nursery stock, sent away from the Government Farm, Kabete, has been fumigated with hydrocyanic acid gas. The bundles of plants were placed in an air-tight box having a capacity of nearly one hundred cubic feet. The chemicals were used in the following proportions:—

Potassium cyanide (98%)	...	1 ounce.
Sulphuric acid ...	...	$1\frac{1}{2}$ ounces (fluid).
Water ...	...	$2\frac{1}{4}$ ounces (fluid).

The water was measured into a glazed, earthenware dish and the acid poured in. This was placed in the bottom compartment of the box, the roof of which is perforated to allow the gas to ascend; all the doors were tightly closed except one small one on the righthand side at the bottom; through this door the cyanide, loosely wrapped in tissue peper, was dropped into the liquid and the door immediately closed.

The plants were allowed to remain in the box for forty minutes to an hour when the doors were opened and, after ventilation, the bundles were removed.

Some such box should be in use in every nursery in the country and a certificate given with stock sold certifying that such stock has been fumigated.

INSECTS AFFECTING STOCK.

As the work done on the distribution of Tsetse in the Southern Masai Reserve has not yet been published and, as there can now be no military objection, I wish to include in this report some of the results obtained.

The Valley of the Southern Guaso Nyiro or Nguruman River.

On the Western side of the river and running parallel to it is a high escarpment, in parts precipitous. Between this escarpment and the river is a low-lying tract of country, swampy, one to three miles wide and covered with dense bush and tall, coarse, rank grass.

On the Eastern side of the river the country is swampy and covered with coarse grass. This area is within the Masai Reserve proper.

This area is a difficult one to travel through as at one time the porters were cutting a path in dense bush and at another wading almost to the neck in swamps. In the dry season this valley must present an entirely different appearance as, when the bush and grass dry they are burned off by the Wanderobo.

The valley, ten miles from the German border, to the Enguruman colony where I crossed the Escarpment, is a fly area. Two species were taken, *Glossina pallidipes* and *Glossina longivennis*.

Glossina pallidipes, Aust. This species would naturally be looked for in such an area as it is nearly always found associated with bush and fairly close to water. It was not confined to the banks of the river but, though not many specimens were taken in any one place, was widely distributed. Though it appeared to be specially active in the mornings and evenings specimens were captured at all hours of the day.

The actual distance from water at which this species was taken was rather difficult to estimate as there may have been water in the bush which we failed to locate. In one case, however, after careful search, four specimens were taken at least two miles from water. These had not followed the porters or been carried on the loads, as I have found to happen in other places. I was well ahead of the safari and caught the specimens myself. As already stated, not many specimens were taken in any one place though the species was widely distributed. This, I think is characteristic of *pallidipes*.

Glossina longipennis, Corti. Contrary to expectation, this species was found to be common on the moist, swampy flats and on the bank of the river. It is commonly associated with drier areas, *e.g.*, the Taru Desert, and is said to avoid water. However, despite the moist atmosphere, it was very active in a region where one would naturally have expected *brevipalpis*. This species was also found to have a wide distribution.

This area is unfitted for stock both on account of the fly and the nature of the pasturage. The Western bank of the river is in the original reserve and, as the Eastern side is flanked by an escarpment almost inaccessible for cattle, the Masai, according to their traditions, have never crossed this area. To get from the Old Reserve to the extension they go further up the river where the escarpment tails off and where there is good pasturage and no fly. They also cross lower down near the border.

The presence of Tsetse fly in the valley of the Southern Guaso Nyiro, therefore, cannot be regarded as seriously affecting the new conditions.

Buffalo and Rhino were plentiful though other species of game were rare.

From the Southern Guaso Nyiro to the Mara or Ngobai.

Both species of Tsetse, mentioned above, were found on the slopes of the escarpment and for six or seven miles in a Westerly direction from the top of the escarpment.

The definite information that *Glossina pallidipes* was taken at an elevation of nearly 4,000 feet is worthy of being put on record. Nowhere in the Protectorate has it been found at so high an elevation though, at one time, it was said to occur at Fort Hall which stands higher. No specimens, however, are extant from that locality.

There were no signs of Masai occupation in this region though cattle kraals were seen close to the edge of it. Evidently they know the area and exactly how near to it they can take their cattle with safety. I was told, however, that they habitually take sheep and goats into this region.

Six or seven miles from the top of the escarpment is the region known as Lengutoto where, at the present time, there are thousands of cattle, sheep and goats.

In Lengutoto, in Morijo, across the Southern edge of the Osobugo lo Loieta, through Rotaik, Sienna and the Southern part of Osero to the Government Station at Engerendi on the Mara River, no fly areas were located.

My collecting boys who know the fly and who also know the character of fly country, were out daily. They were accompained by Masai interpreters and I am sure that, if fly had existed in the vicinity of any of the places passed through, we should have heard of it from the Masai who know it well.

The Valley of the Mara River.

During the time spent on the banks of the Mara or Ngobai River the climatic conditions were very unfavourable. The sky was overcast, there being practically no sunshine, and rain fell every day. Under such conditions it is quite possible to pass through a known fly area without finding a single specimen.

I would suggest, therefore, that this area be examined again when the weather conditions are more favourable, either after the first rains have fallen or shortly after the rains have ceased.. Here the Masai pointed out several places where, they said, fly could be found but no specimens were obtained.

Owing to the floods it was not possible to cross the Mara so that I had to return to the bridge which is about six miles down the river from Engerendi and about forty-five from the border. Neither on the way down the river nor on the return journey, when a different route was taken, did we find a single specimen. This, as already explained, may have been due to climatic conditions. On the opposite bank of the river, on a tributary called the Enderit, the late Mr. Woosnam found the true *fusca*, which is the only record of this species in the Protectorate.

The Magor or Gori River. As I had only until the first week of June to complete the tour, it was not possible to examine more than a small part of the Gori Valley. From the Mara bridge the route taken was by the new track which is being cut towards Kisii. from the point where this track crosses the Magor and for

some short distance down the river, no fly were found. Most of the river thus remains to be examined but, as there are thousands of cattle and donkeys in the country bordering the river, it is probable that the valley is free.

From the Mara River to Naivasha.

No fly areas were found on the return journey to Naivasha which was through the Lemek Valley, across the Loieta Plains and over the Mau Escarpment.

Fleas sent in by Veterinary Officers.

During the year several tubes of fleas have been sent in by Veterinary Officers. These were mostly from dogs and were in nearly every case *Ctenocephalus felis*, though a few were *Ctenocephalus canis*.

THE CULTIVATION OF SILK.

Silk is an animal fibre produced by some insects in the shape of a cocoon or covering which encloses and protects them during the pupal or resting stage. On account of its beauty, elasticity and durability it is the most valuable of all animal fibres for clothing purposes.

With a large native population, in those parts of the Protectorate which are suitable, there is no reason to doubt but that, with proper teaching and supervision in the initial stages, this part of Africa could produce large quantities of raw silk which would have a distinct effect on the economic condition of the country.

As the work could be done easily by women and children the fostering of a silk industry would have little effect on the labour supply required by planters and others. There are no practical difficulties in the way and, moreover, "even the roughest form of silkworm cultivation must be regarded as a work of culture of the highest description and will soon have an influence on the quicker civilisation of those tribes that practise it."

With a little encouragement and perseverance the more intelligent native could be taught spinning and weaving and instead of exporting raw silk it could be manufactured into cloth in the country.

The silkworms which have been experimented with are:—

1. The Eri Silkworm.
2. The Mulberry Silkworm.
3. Indigenous Silkworms.

Eri Silk.

The caterpillars of *Attacus ricini*, Boisd., the Eri Silkworm Moth, feed on the leaves of the castor oil plant, (*Ricinus communis*). The plant, of which there are several varieties in the country, grows very much like a weed and with a little extra cultivation, will produce large quantities of foliage. It grows and thrives even in very dry weather so that, unless the seasons are very abnormal, continous broods of worms can be fed.

The silk produced by the caterpillars cannot be reeled. In this it differs from the cocoon of the mulberry silkworm from which a continuous thread can be obtained. It is spun and woven in the same way as cotton and on any ordinary loom can be made into a strong, durable cloth which takes dyes easily.

In the first instance, a consignment of live cocoons were received from the Imperial Entomologist of India, to whom I am indebted for his valuable assistance not only for the initial consignment but also for the literature which he has placed at my disposal. Much detailed work has been done in India by the Agricultural Research Institute, Pusa, on the rearing of the worms, the treatment of the cocoons and on reeling, spinning, weaving and dyeing. The directions given in the Indian publications, "Memoirs of the Department of Agriculture, Eri Silk," and "Directions for the cultivation of Eri Silk," have been followed at Kabete.

Samples of the silk, grown and prepared solely by natives, have been sent to the Imperial Institute for valuation and report.

As a native industry, Eri worms can be reared by women and children and would not interfere with their work in the fields. For rearing, all the apparatus necessary can be made by the natives themselves. The thread could be spun in the huts or the cocoons sold to some central place where trained natives could do the spinning and weaving.

Briefly the apparatus necessary and the methods followed are:—

Rearing House.

The rearing house at Kabete can be taken as a sample of what is required. It is built of wattle poles and roofed with grass, the sides also being of grass. As good ventilation is essential, the upper portions of the side walls are made so that they can be lifted up to admit of a free circulation of air. The earthen floor is kept clean and in dry weather is sprinkled with water to lay the dust. No nails are required in the construction as all the parts can be tied tightly together with locally made rope or with the indigenous fibre used in the building of native huts. In districts where thatching material is scarce the house could be made with mud walls and banana thatch.

Inside the building a series of staging, round the sides and along the centre, is erected to hold the trays on which the worms are fed.

The shape of the building is immaterial; an ordinary round native hut with some extra ventilation would meet the requirements on a small scale. A frame-work made of wattle or bamboo would stand in tins, in which some water is poured, to prevent the ascent of ants.

Trays.

The trays used at Kabete are made of one inch wood and covered with ordinary close-mesh matting such as is used for sleeping mats and easily obtainable in any bazaar. Mats which would answer the purpose quite as well can be made by the natives.

The ends are prolonged slightly to act as handles, though this is not really necessary. A cross piece adds strength to the tray.

If the worms are to be reared on a large scale the number of trays required would be considerable and would add to the cost. Ordinary strong canvas or mat is simply stretched across the staging and fastened securely. Provided the staging is not too wide, very little extra attention is necessary to keep the worms clean.

Spinning Baskets.

Some sort of basket is necessary in which the full fed worms will spin their cocoons. A box is not suitable as, during the spinning, the worms require good ventilation. The basket made by the Kavirondo are excellent for the purpose but should be provided with a lid.

When the worms are ready to spin, a layer of loosely crumpled paper, wood shavings, clean dry, straw or leaves is placed at the bottom of the basket and the worms dropped in; another layer of material then more worms and so on till the basket is full. The lid is closed and a weight placed on it or the basket is turned upside-down. A Kavirondo basket which measures about one and a half feet deep and two feet in diameter is sufficient for nearly one thousand worms.

A pamphlet is in course of preparation dealing fully with the different stages in the life history and giving full instructions for rearing the worms. A leaflet will also be issued in the Swahili, Kikuyu and Kavirondo languages, giving instructions in a simple form.

It is my intention to start a rearing house at Kibos and another at Machakos. I have one trained Kavirondo boy who could take charge at Kibos and instruct the natives, if they so desired.

Some sort of arrangement, however, will have to be made whereby the cocoons will be purchased for cash by this Division. If this is not done, there is sure to be, at the beginning at least, a certain amount of discouragement if natives have to wait until the cocoons are sold at home.

IMPERIAL INSTITUTE REPORT ON ERI SILK FROM BRITISH EAST AFRICA.

The sample of Eri silk which is the subject of this report was forwarded to the Imperial Institute by the Government Entomologist at Kabete and is referred to in his letter dated 6th June, 1917. It was stated that the silk had been prepared by a native by boiling the cocoons in a solution of washing soda and then teasing out the silk with the fingers. It was desired to ascertain whether the silk would be marketable in this form or, if not, how it should be prepared.

Description of Sample.

The sample weighed 5 ozs. and consisted of a tangled mass of clean, soft, degummed silk, varying in colour from cream to pale brown.

The material possessed the usual appearance, lustre and strength of Eri silk. The single fibres of the silk were of normal character when viewed under the microscope; the diameter varied from 0.0003 to 0.0012 inch, being mostly about 0.0008 inch.

Commercial Valuation.

The sample was submitted for suggestions and valuation to the Silk Production Committee of the Imperial Institute, who advised that this Eri silk should not be degummed in East Africa before shipment, but that the cocoons should be exported after being turned inside out to free them from dirt, etc. A machine for the reversing of the cocoons, and the method of using it, is described by Lefroy and Ghosh in their monograph on Eri silk in "Memoirs of the Agricultural Department of India (Entomological Series)" Vol. IV. p. 78, and it is suggested that the use of this machine in East Africa should be considered. The reversed and cleansed cocoons should be packed in bales for shipment, the white and brown cocoons being packed separately.

The sample was stated to be of similar quality to consignments of Eri silk recently received from Assam and was valued as follows in the United Kingdom:—

	per lb.
Degummed (in the condition of sample) ...	4s.
"Reversed" cocoons	3s./6.
Ordinary pierced cocoons	3s.

Remarks.

The Silk Committee suggest that it would be advantageous if a small consignment of 250 lbs. of these cocoons, "reversed" if possible, could be forwarded to the Imperial Institute so that experimental trials can be made. It will then be possible to furnish a definite report on the quality and value of the silk.

March 25th, 1918.

Mulberry Silk.

In November 1915, I wrote to the Director of Agriculture, Cyprus, asking for an ounce of eggs. Owing to delay in the microscopical examination these were not despatched until January 1917 and arrived here in March.

Most of the young worms had hatched on the journey but sufficient were left to make a start.

The eggs are those of *Bombyx mori*, univoltine race crossed with a Bagdad variety and had been reproduced for three years in succession in the Sericultural Station of the Department of Agriculture. Before dispatch they were microscopically examined after the Pasteur system.

The Mulberry, of which there are several varieties already growing in different parts of the Protectorate, is the natural food of the silkworm and the white mulberry, *Morus alba*, has been found to be the most suitable variety.

A sample of the silk grown at Kabete has been forwarded to the Imperial Institute for report but this has not yet been received.

From the cocoon the silk is unwound as a continuous thread and this necessitates the killing, by heat or fumigation, of the pupae before the moths emerge. As the cocoons are bulky and take up considerable space, thereby adding to the cost of shipment, the intention is to teach the natives to unwind the thread and either export it as raw silk or spin and weave it here.

Practically the same apparatus is required as has been described for the Eri worms and full instructions for rearing will be published in pamphlet form.

Indigenous Silk.

Very little has been done with regard to wild silk as the time has been taken up fairly well with other things.

Insects Affecting Stored Products.

On a small scale stored products can be fumigated to kill weevil and other pests but it is not possible to obtain the necessary chemicals to do this on a big scale. Moreover, some buyers will not touch fumigated maize. Experiments have been conducted with heat, raising the temperature of the store to a certain point and keeping it at that for a certain time. These, however, are by no means complete and a report will be submitted later. The points which have to be determined are, the design of the building, the correct temperature, length of time necessary and the amount of fuel.

Insects Affecting Public Health.

In this connection, I attach a copy of a report sent to the Medical Officer of Health, Mombasa. I need hardly point out the importance of such work.

Entomological Laboratory,
Kabete,
29th January, 1918.

THE MEDICAL OFFICER OF HEALTH,
MOMBASA.

Sir,

I have the honour to submit a report on the 24 tubes of fleas forwarded by you.

You will see from the table attached that *Xenopsylla cheopis* is not the common flea in Mombasa as has always been supposed. It is not possible to form any definite conclusions from such a small amount of material and I should like 24 tubes a week for a year before calculating the percentage of the different species.

I cannot find any record of *Xenopsylla brasiliensis* from Mombasa and it is possible that this is the first record from Eastern Africa. It is a common flea in India and was possibly introduced into Brazil.

If it is possible, I should like more than 24 tubes a week as the seasonal prevalence and reproduction of fleas are markedly affected by conditions of temperature and humidity. It has been found, though this has never been done for East Africa, that the period of the greatest prevalence of the rat flea is also the season of the maximum intensity of the disease. The average number of fleas per rat (*cheopis*, almost without exception) in Bombay varies from 6.7 and 6.8 in March and April, the height of the plague season, to 2.9 in October: In Punjab an average of 12.6 has been found in April which is the beginning of the hot weather and the time of the heaviest mortality from plague, as against 2.0 in August, when the disease is dying out.

Would it be possible for you to get temperature and humidity returns for Mombasa from now onwards?

I have the honour to be,
sir,
Your obedient servant,

Sd. THOS. J. ANDERSON,
Entomologist.

Rate No.	Species of Rat	Date	Xenopaylla brasiliensis, Baker		Xenopaylla cheopis, Rothsch		Ctenocephalus felis, Bouche
			Males—Females		Males—Females		Female
1	Mus decumanus	15-12-17	4	5			
2	,,	12-12-17	2	–			
3	,,	12-12-17	2	4			
4	,,	13-12-17	7	1			
5	,,	13-12-17	3	2			
6	,,	12-12-18	2	3			
7	,,	14-12-17	3	2	1	–	
8	,,	14-12-17	2	–			
9	,,	14-12-17	4	2			
10	,,	15-12-17	–	1			
11	Mus alexandrinus	13-12-17	7	1			
12	,,	12-12-17	4	2	1	2	
13	,,	13-12-17	4	4	1	1	
14	,,	12-12-17	1	1	1	1	
15	,,	14-12-17	4	1	–	1	
16	,,	15-12-17	6	4			
17	,,	14-12-17			3	3	
18	,,	15-12 17	1	–	2	2	
19	,,	15-12-17			5	–	
20	,,	14-12-17			4	1	
21	,,	15-12-17	8	2			
22	,,	12-12-17			–	2	1
23	,,	13-12-17	6	–	2	–	
24	,,	13-12-17	3	3			
			73	38	20	13	1

Total number fleas—144
average number of fleas per rat—6
Exmaination of 24 tubes of fleas from M O.H. Mombasa.

Entomological Laboratory,
Kabete,
29th January, 1918.

ANNUAL REPORT

OF THE

Foreman Plant Instructor

ON

Coconut Beetle Trap Work and Native Coconut Cultivation

FOR THE

Year Ending 31st March, 1918.

Agricultural Department,

Mazeras.

THE HON'BLE THE DIRECTOR OF AGRICUPTURE,

AGRICULTURAL DEPARTMENT,

NAIROBI.

Through the Chief of the Entomological Division.

Sir,

I have the honour to submit my Annual Report in connection with the Coconut Beetle Traps and Coconut cultivation by natives generally, for the year ending 31st March, 1918.

Number of Traps.

The number of established traps remains the same as last year and located as follows:—

Where traps are to be found.

District.	*Traps.*	*Nos. of Traps.*
Mombasa and Kilindini ...	25 ...	1 to 25
Changamwe, Jomvu and Miritini	72 ...	1 ,, 72
Mazeras Government Farm ...	3 ...	73 ,, 75
Mazeras, Rabai Road ...	16 ...	76 ,, 91
Kisimani	12 ...	92 ,, 103
Rabai, Jumba, Milege, Kalolani Road, Changombe ...	76 ...	104 ,, 179
Mwakirunge	14 ...	180 ,, 193
Mwirarani	18 ...	194 ,, 211
Junda	14 ...	212 ,, 225
Frere Town, Junda Road ...	25 ...	226 ,, 250
Frere Town, Maweni ...	11 ...	251 ,, 261
Frere Town, Malindi Road ...	50 ...	262 ,, 311
Frere Town, English Point (Nyali)	14 ...	1 ,, 14
Gazi-Msembweni	100 ...	1 ,, 100
Total ...	450 ...	—

Owing to transport difficulties, etc., the 100 traps at Gazi were looked after by the management of that place during the last quarter of the year, in consequence of which the returns of insects collected from them for that period are not included in the following figures which represent the number of insects caught in the traps during the year:—

Insects caught in traps.

Month.	*Trees cut.*	*Beetles.*	*Grubs.*	*Pupae.*	*Eggs.*
April ...	37 ...	656 ...	3546 ...	260 ...	49
May ...	147 ...	599 ...	2874 ...	222 ...	130
June ...	66 ...	294 ...	1583 ...	110 ...	Nil
July ...	93 ...	398 ...	2178 ...	259 ...	,,
August ...	14 ...	253 ...	1484 ...	173 ...	,,
September ...	88 ...	805 ...	4709 ...	578 ...	,,
October ...	89 ...	465 ...	2829 ...	351 ...	,,
November ...	69 ...	360 ...	2068 ...	263 ...	,,
December ...	93 ...	475 ...	2753 ...	339 ...	,,
January ...	29 ...	88 ...	413 ...	58 ...	,,
February ...	69 ...	320 ...	1407 ...	235 ...	,,
March ...	125 ...	472 ...	2198 ...	313 ...	,,
Totals ...	919 ...	5185 ...	28062 ...	3161 ...	179
Per month ...	76.7 ...	432.1 ...	2338.6 ...	263.5 ...	—

Ravages of the Beetles and its method of attack.

In order to dispel any doubts from the mind of any person who may be interested in coconut cultivation, as to whether, or not, these insects are injurious, it need only be pointed out that they attack the palm at its growing point at the bases between the petiole of the outside uppermost pair of leaves, and burrow into the outerside of the inner petiole of folded leaves.

These attacks begin and are generally confined to the soft tissues situated there, at the top or crown of the palm, from where new leaves, flowers and subsequently the fruit obtain their nourishment, hence any injury to that part of the palm gradually, and sometimes rapidly results in debilitating the whole plant and eventually death ensues.

Preventative against Beetle attacks.

The writer has tried certain experiments in connection with this Beetle and its mode of attack on coconut palm: and it has been proved conclusively that an application of tar followed by sharp coarse sand (not loamy sand, but sand from the sea shore) to the bases or axils of the uppermost leaves of young palms is a preventive against Beetle attacks.

Coconut growers may try this remedy together with Beetle spearing, clean cultivation and the removal of all decayed and decomposing vegetable matter from their shambas.

Hiding places of the Beetle.

Occasionally holes may be seen in an old trunk below the growing point; and even though Beetles may be found living or hiding in them, it must be borne in mind that Beetles never do burrow into the hard old wood of the coconut palm; and that these holes were made when such parts were located at the crown or growing apex. It was observed that both male and female insects burrow into the palm.

Constrution of Beetle Mandibles.

The mandibles of the Beetle are constructed like a mill with a more or less corrugated surface through which the juice is expressed. The insect gnaws into the palm by means of these and within an hour is quite capable of working its way with such rapidity as to cover about half its own length.

This has been demonstrated by the writer on a section of a young coconut palm which portion included the crown.

The fresh fibre take from the burrow or excavation was entirely dry, which makes it quite obvious for one to assume that the purpose of this gnawing of the Beetle is solely to extract the juice as food.

This Beetle does not eat.

On dissection of a few Beetles the fact was demonstrated that the inside contained no masticated fibrous matter at all but simply a darkish fluid.

Larvae of the Beetle destructive.

An idea seems prevalent among certain persons that the larvae of the Beetle are harmless. As a matter of fact, the writer has found larvae, heaps of times among freshly gnawed fibrous matter where no Beetles were seen, and where it seems quite probable that the fibrous material was the result of their presence.

Eggs.

In regard to the deposition of the eggs, these are usually deposited by the female insect in the immediate vicinity of a supply of food. I may add that no eggs have been found in the burrows which have been made in a living palm or in a palm not completely dead, though larvae have occasionally been observed in such places.

Construction and maintenance of traps.

In a previous Report, 1913-14, the cost of construction was estimated by the writer at Rs. 1/98 per trap irrespective of posho allowance and transport.

With regard to maintenance and reopening 3 times per year a careful estimate has been arrived at by which the cost is estimated to be approximately Rs. 1/50 per trap for each opening, such factors enter into the situation as the possible fluctuation in the wages of labourers, transport difficulties, localtiy and the distance between the position of the traps and the place where the necessary material to supply the upkeep of them is to be found.

Labour.

The labour question at the beginning of the year was a very acute one. Porters occasionally deserted under the pretext of the price of food and the alleged insufficiency of the posho allowance to meet it.

Supply abundant.

During the latter part of the year the conditions changed. The excessive drought, which resulted in the lack of food in certain districts, has had the effect of introducing an abundant supply of labour to the various plantations and also in the vicinity of towns.

The ruling wage at present varies but in some districts Rs. 10/- to Rs. 12/- with, and in some cases, without posho.

Rainfall Record.

The following is the rainfall for the period under review:—

Month.	*Inches.*
April	10.28
May	5.85
June	0.91
July	0.91
August	1.76
September	Nil
October	0.86
November	0.97
December	7.44
January	0.48
February	Nil
March	Nil
Total ...	29.46

Coconut cultivation.

In spite of the protracted drought, coconut planting was much in evidence.

It is also very gratifying to note that it has been observed that some attempt has been made at intensive cultivation in a few instances by small growers.

Still the necessity arises of again pressing the matter of the desirability of:—

(1) A system of clean and thorough cultivation.

(2) The cutting, burning or burying of all dead and dying palms.

(3) The removal of many heaps of coconut husks, which are invariably covered with fungus and which are allowed to accumulate about the plantation.

(4) The prohibition of the indiscriminate hacking of the leaves of young plants.

Copra.

During the year the local price of copra fell considerably; and coconut growers generally asserted that it was more profitable to sell the ripe nuts, as gathered from the palm, than to convert them into copra.

The fall in price of copra is said to be due entirely to congestion at the Port, caused through lack of shipping facilities.

Local price of ripe Coconuts.

The price for ripe nuts varied according to size from 4 cents to 8 cents each: and for seed nuts for planting from Rs. 45/- to Rs. 80/- per 1000.

There is usually a great demand for fully ripe seed nuts and also for such ripe nuts as are unfit for seed and which are used by natives and others for culinary purposes.

Tembo.

In my Report 1916-17, it is stated that tembo tapping and tembo drinking had decreased by about 50 per cent; which was due largely to the fact that the men who are usually engaged in that pursuit were given a better opportunity of making themselves useful elsewhere.

Palm wine not flowing copiously.

This year there has been even a much greater decrease due to various causes but principally to the excessive drought which greatly affected the flow of the sap of the palm and which incidentally caused a great increase in the retail price of the liquid, which frequently was unobtainable.

Makuti.

Makuti another product of the coconut palm prepared from the dry fallen leaves and which is largely used as roofing material for native houses remained at the same rate, *i.e.*, 25 to 30 pieces per Re. 1/-.

I have the honour to be,

sir,

Your obedient servant,

H. DOPWELL,

Plant Instructor.

Mazeras Government Farm,

April 30th, 1918.

ANNUAL REPORT

ON THE

Government Stock Farm—Naivasha,

FOR THE

Year ending 31st March, 1918.

NAIVASHA GOVERNMENT FARM,
April 30th, 1918.

THE HONOURABLE,
THE DIRECTOR OF AGRICULTURE,
NAIROBI.

Sir,

I have the honour to submit my report for the year ending 31st March, 1918.

The rainfall during the year was as follows:—

1917		*Inches.*
April	...	8.71
May	...	3.59
June	...	1.91
July	...	1.57
August	...	4.12
September	...	2.45
October	...	1.35
November	...	.10
December	...	nil
January 1918	...	1.53
February ,,	...	nil
March ,,	...	.03
Total inches	...	25.36

As I was in Australia on leave I did not resume the management till August 1st my report will commence from that date.

The cows showed that they had been heavily milked for Military Hospitals and the signs of this was visible in the calves. The cattle as a lot did well but were not in the same condition as usual, probably due to the drought and heavy milking.

The pure bred Shorthorns have done well.

The Friesland cattle continue to be a success and are good breeders and milkers.

The pure bred Hereford cattle, as mentioned in all my previous reports have not come up to anticipations.

The pure bred Ayrshire cattle have again fulfilled expectations the increase being splendid and have proved good milkers; the only cattle that compare with these in increase are the Friesland. I may mention that all the milking breeds of cattle have given a much better return of calves than any of the beef breeds.

The pure Guernsey shorthorn cross are exceedingly nice cattle and are good milkers and are a cross worthy of marked attention.

Grade Cattle.

The grade Shorthorns are giving very satisfactory results and are nice animals and good milkers. We have up to the 5th and 6th cross in this line.

The grade known as the Guernsey shorthorn, is Guernsey on native and then Shorthorn on each cross afterwards. These cattle are good and are worthy of special notice for dairy farming. I have mentioned this grade in my reports for the last eight years as of good promise.

The Friesland grades are bred from imported Cape Colony cows and are of good quality.

The Hereford grade cattle appear to be doing much better now but they are poor milkers and they have not done so well as the other breeds on this farm.

The Ayrshire grades are a success and the results of crossing with native cattle have been all that we can desire.

A very nice Hereford bull which was purchased at the Sydney Royal Show in April 1917, has arrived and is in good condition; he was bred by Mr. Reynolds of New South Wales a noted Hereford breeder. An Ayrshire bull was also purchased from Mr. Andrew Buchanan of Gleneira Flinders Victoria. This is a very nice animal but is smaller than any of our own, he was purchased purely on milking records of his fore parents and all his fore line of sires and dams.

I also purchased an exceedingly fine Shorthorn bull from Anthony Horden of Bowral, this bull also came off the Sydney Royal Show but unfortunately he died at Kabete Laboratory before we were able to get any use out of him.

Sheep.

We have many varieties of sheep on the farm including pure Merino, pure Suffolk, pure Lincoln and pure Shropshire and also each of these pure breeds crossed on the native ewes, with good

results, up to the 6th and 7th cross in many of these crosses. The wool of the higher grade Merino is practically pure Merino wool and has always been very well reported on by our London Agents.

The Suffolk cross on the native ewe gives a very nice mutton animal and the demand for rams of this grade is very marked.

The crossing of the pure Merino with the native sheep has been a success in every way.

There is not the slighest doubt but that the importation of a batch of stud ewes and some rams from Messrs. Falkiner & Sons, Boonoke, New South Wales, some time ago, has improved our flock very considerably, and this improvement has been maintained by subsequently importations of a few rams from the same firm. When on leave I purchased live stud rams from Boonoke and these arrived here in May last.

The clip shorn in October 1916 and sold in London on the 1st of June, 1917, was well reported on, the details of sales are as follows:—

23	bales	brought	22	pence	per	lb.
6	,,	,,	19	,,	,,	,,
5	,,	,,	18	,,	,,	,,

34 bales in all, which shows that our average bulk return for the whole clip was exceedingly good; and the lowest price received for locks, etc., was 10 pence per lb.

The sheep this year suffered from disease more than usual and the losses were high; I take it that this was due to abnormal climatic conditions, but notwithstanding this the sheep have paid well.

Goats.

The Angora and grade goats have suffered badly with worms otherwise they did well. The price obtained for the mixed grade clearly to be seen.

Donkeys.

The crossing of the native Donkey mares with the imported Catalonian Jack continues to be a success. The progeny are very nice animals and are in great demand.

Ostriches.

These are still on the farm but owing to the war and fall in price nothing has been done with them lately.

Horses.

The stallion "Royal Fox" is still in good demand by settlers. He has proved himself a good foal getter and they are of excellent quality.

Sale.

The annual sale took place on April, 19th, 1918, about three weeks later than was at first intended, this was due to drought and shortage of feed.

A large number of buyers were present and bidding was very brisk throughout the day and the prices obtained were good it was a record sale for this farm, and settlers seemed well pleased with the arrangements made. Two motor cars ran all day between the Railway Station and the Farm taking everyone to and from the sale. His Excellency the Acting Governor Sir C. Bowring attended the sale with the Hon. the Director of Agriculture and the Traffic Manager, Uganda Railway.

The following are the prices obtained:—

5 Shorthorn bulls, sold from £94-10 to £157-10-0, average price £117-8-2.

11 Friesland bulls, sold from £75-10 to £178-10-0, average price £117-8-2.

14 Ayrshire bulls, sold from £32 to £178-10-0, average price £71.

2 Hereford bulls at £26-5-0 and £31-10-0.

2 Guernsey Shorthorn crosses (bulls), sold at £110-5-0 and £141-15-0.

1 Friesland grade bull, sold at £110-5-0.

6 Grade Hereford bulls, third and fourth crosses, sold from £10 to £19, average £14-3-4.

3 Grade Shorthorn bulls, sold at £95-0-0, £45-0-0 and £30-0-0.

4 Grade Ayrshire bulls, sold at £25, £25, £25 and £30.

127 Pure Merino rams, sold at £8-15-0, top price being £15-6-0.

20 Grade Suffolk rams, averaged £7-7-8 each.

20 Very young grade Merino rams, averaged £0-16-8 each.

180 Very young Wethers, averaged £0-14-8 each.

30 Grade Angora he-goats, averaged £0-15-1¼ each.

14 Half bred Catalonian Jackasses, averaged £12 each.

General Remarks.

None of the stock have been pampered or kept in a way that any private person would not do.

All bulls both pure and grade are grazed out and not fed till ten or twelve months old when they get a little meal night and morning, but graze in the day time as usual; as regards the bulls sold at the sale quoted above only eight had been fed for any length of time the remainder had only been fed on mealie meal, grass, hay and a little ensilage for three weeks to a month before the sale, this was done as we were very short of foodstuffs of any kind owing to drought, in consequence many of the bulls did not look as well in my opinion as I would have wished, and the same remark applied to the rams.

To the pure merino rams during tupping time I always give a feed of crushed maize night and morning. I am also a believer in giving young merino rams in this country a little feed of some kind, lucerne or crushed maize or something of that sort and letting them graze out all day. I find they do ever so much better when treated this way, the feed being discontinued at a later date and resumed at tupping time. Unfortunately I have not been able to carry out this plan during the year under review, owing to drought and the very high cost of maize, also lucerne was unobtainable.

The Stockman, Mr. Armstrong, was transferred to the Military Livestock Branch, Naivasha, with rank as Corporal on April 17th, 1917.

Cultivation.

The usual cultivation was done at the lake front and main boma but the rising of the lake destroyed all crops planted there, which was a big loss; all that remained was the mealie meal patch for ensilage at the main boma.

Little or no hay was made from the meadow grass, it having been lost I understand through rain in the early part of the year under review and this has since proved a very serious loss to the farm.

General repairs have been many, all the main boma and stables at my house had to be repaired, the necessary timber for these repairs was carted from the Forest Reserve, some of the sheds were pulled down and rebuilt also all the yards and bull and horse boxes had to be refilled with earth. Repairs to fencing were carried out.

A new large sheep dip was built during the year which will be a great help; this dip was built beside the cattle dip in order to concentrate work and water supply.

A new well with pump was also built, the supply of water is good and plentiful, this well is in the outer paddock near Naivasha.

I have the honour to be,
sir,
Your obedient servant,

N. A. MacGREGOR,
General Manager

ANNUAL REPORT

OF THE

Department of Agriculture.

NAIROBI EXPERIMENTAL FARM,
KABETE.
June 1918.

THE HONOURABLE,
THE DIRECTOR OF AGRICULTURE,
NAIROBI.

Sir,

I have the honour to submit my tenth Annual Report upon this Farm for the year ending 31st March, 1918.

Weather.

Fairly good crops were obtained after the long rains of April, May and June. During these months we had over 28 inches of rain and on several days very heavy rainfall was registered, notably 4.41 inches on 30th April; 3.03 inches on 20th May and 1.31 inches on the 10th June.

Rain commenced for the short season with 0.25 inches on the 7th October and continued during the remainder of the month on 12 days during which time we had 5.18 inches. In November 1.70 inches fell over 7 days and there the rains ended. The accompanying Tables, "A" and "B," Meteorological, give the general weather conditions for this and the preceding years.

Table "A."—Meteorological.

Latitude :—1°14′ 30·94″; S ; Longitude :—36°43′ 31·78″; E ; Height above sea level :—6,000 feet.

Month.	Inches Rainfall.	Highest Rainfall.	Date of highest Rainfall.	No. of days with 0·01 or over.	Average maximum Temperature.	Average minimum Temperature.	Average Dry Bulb.	Average Wet Bulb.	Average Ground Thermometer 4 feet.	Average Ground Thermometer 1 foot.
1917.										
April	16.08	4.41	30th	25	70.8	54.8	61.5	58.7	68.7	67.00
May	7.16	3.03	20th	14	70.8	53.4	59.3	57.7	68.1	66.4
June	4.94	1.31	10th	11	67.6	50.5	58.8	58.1	67.5	65.2
July	0.67	0.35	4th	5	68.7	47.5	56.4	55.9	66.9	64.8
August	2.13	1.00	1st	7	78.8	48.9	56.5	55.6	67.1	65.6
September	1.94	1.04	12th	7	72.9	48.6	58.5	58.1	67.1	65.8
October	5.18	1.61	31st	12	73.4	56.6	60.1	59.8	67.9	67.00
November	1.70	0.88	16th	7	72.7	50.6	63.2	63.1	67.4	66.9
December	0.07	0.07	5th	1	76.6	45.8	64.00	57.2	68.7	69.2
1918.										
January	0.14	0.12	11th	3	77.6	46.3	65.00	56.9	70.00	69.6
February	0.15	0.15	3rd	1	78.6	47.8	63.00	56.3	70.8	70.3
March	0.51	0.35	7th	3	79.9	49.1	63.1	58.4	71.7	71.3
Totals	40.67	—	—	96	879.4	600.9	729.00	695.8	821.5	809.1
Averages					73.1	50.1	60.9	58.00	68.5	67.4

Table "B."—Meteorological.

	1909-10.	1910-11.	1911-12.	1912-13.	1913-14.	1914-15.	1915-16.	1916-17	1917-18.
Rainfall ...	34.22	31.67	54.34	51.17	34.04	37.62	41.07	34.85	40.67
Number of days with rain ...	—	129	143	148	143	112	127	166	96
	Nov.	May	Feb.	April	March	April	April	April	April
Wettest month with rainfall ...	7.99	5.96	13.90	12.19	9.09	10.00	8.85	13.52	16.08
Mean:									
Dry Bulb	61.9	63.6	61.9	62.1	61.6	63.1	63.3	62.5	60.9
Wet Bulb	56.7	56.3	56.8	57.6	56.9	58.4	59.4	58.4	58.00
Maximum Thermometer ...	73.9	72.8	73.5	72.6	73.6	74.9	74.1	71.9	73.1
Minimum Thermometer . .	51.8	50.1	51.6	51.7	52.5	53.00	51.7	51.00	50.1
Ground Thermometer 4 feet ...	—	—	—	69·3	69.5	70.8	70.7	68.5	68.5
Ground Thermometer 1 foot ...	—	—	—	68.3	68.5	69.9	69.5	67.2	67.4

Maize.

An area of 20 acres of different varieties of this crop was planted during the long rains but of this area only 5½ acres of "Hickory King" was harvested and it yie ded at the rate of eight bags (of 200 lbs. each) to the acre.

The remainder was used as feed in the dairy section.

It will be noted that the rainfall was excessive at the time this crop was planted and this accounts for the comparative failure.

Beans and Peas.

Eighteen acres of these crops were planted at various times. "Canadian Wonder" Beans, planted on 5th June and harvested on 2nd October, 1917, yielded eleven loads (of 60 lbs. each) to the acre. "Rose Coco" Beans, planted on 1st June and harvested on 10th October, 1917, yie ded eight loads per acre. An acre of "Soya" Beans, planted on 17th April and harvested on the 13th September, 1917, yielded 100 lbs. of seed. This is the best success which has, so far, attended this variety of bean in our district.

"Telephone" Peas took five months to grow and yield 10 loads per acre.

Wheat.

Eight acres of Cross No. 13 and Cross No. 11 were planted in May, 1917, and yielded seven loads per acre.

A good sample of grain was obtained and, in spite of the season, rust did comparatively little harm.

A very large number of different varieties have been experimented with in small plots. Particulars of these will be found in the Mycologist's Report.

Barley.

Four acres were planted on the 2nd May, 1917, but the excessive rain seemed to do most harm to this crop. What did come to maturity was attacked by birds and very little seed was obtained.

Potatoes.

The following varieties of these were planted.—"Duchess of Cornwall," "Ninety-fold," Carter's "Early Factor," "Rayne's Park," Carter's "Mainstay," "King George" and "Factor" but the yields from all were comparatively small; the best yielding two and a half tons per acre.

Flax.

A separate report on this fibre is submitted by Mr. H. Simpson, Flax Instructor.

Coffee.

This crop continues to do well and during November and December the plantation was pruned and put in order.

Sugar Cane.

This gives promise of being a crop suited to vigorous growth in many parts of the country.

All the varieties on the farm have grown excellently and a large amount of cane has been disposed of to various Settlers. We also fed it heavily to the dairy cows here.

Rotations.

Owing to my absence at Naivasha and the drought during the latter part of the year under review, I am unable to give any results.

Orchard.

This was in charge of Mr. J. J. Adams until November, 1917, when he left to take up a private appointment in the Protectorate.

The following fruit trees have been disposed of during the year:—

Lemons	...	1,643
Oranges	...	296
Limes	...	184
Naartjees	...	42
Plums	...	80
Seedlings	...	28
Total	...	2,273

Pests.

Birds were exceedingly numerous this year and only by the adoption of strenuous measures could seed be saved from our special Wheat varieties.

Thrips appeared on the Coffee towards the end of the year but only a very small portion was attacked.

Homestead.

With the exception of a three-roomed stone house for the Station Assistant, no new permanent buildings have been erected on the farm.

A considerable amount of work, however, has been done in repairing the temporary buildings.

Labour.

Labour has been plentiful throughout the year.

General.

This has been an abnormal year, firstly owing to excessive rains, and, secondly, on account of excessive drought, so much so that no results whatever can be given for all the work and labour expended on the second season's crops. We have, however, been very busy supplying milk to the Military Hospitals in Nairobi, the supply to which averages about 65 gallons per day.

During February and March we had a period of considerable anxiety with the stock, due to the drought, but I am glad to record that we managed to meet the situation successfully by purchasing maize stalks extensively from the natives in the neighbourhood. This, in a sense, directly benefited the native who, under the circumstances, would have received no return whatever from his crop.

During the year several settlers have sent their boys here to be trained in Flax and Citrus culture.

Live Stock.

All the stock were double inoculated for Rinderpest in September. The general health has been good. There have been one or two cases of East Coast Fever in spite of the fact that we use a three-day dip always well up to strength. A few calves have been lost with scour.

The following stock were despatched from the Farm during the year:—

Grade Bull and other cattle ...	4
Sheep	19
Pigs	63
Total (all classes) ...	86

Stock on Hand.

The Farm was carrying, at the end of the year:—

Cattle	644
Sheep	72
Horses	2
Mules	3
Pigs	61
Eland	1

Correspondence.

1,055 letters were received and 1,181 have been despatched during the year.

Visitors.

There have been numerous visitors during the year and many have evinced a distinct interest in the country and its prospects. As is naturally to be expected in these times, the Farm has been visited by many soldiers who expressed their intention of settling in the country when time and opportunity permit.

Staff.

Mr. H. Powell was Acting Manager here until my return from the Government Farm, Naivasha in August.

Mr. McNaughtan has carried out his farm duties satisfactorily. He was seconded to the Administration from December 1917, until the end of the year for the purpose of inducing the natives to grow what crops they could under irrigation and thus make more use of the large quantities of water which we have in our permanent streams.

Mr. J. J. Adams, Agricultural Instructor, left the Farm on the 27th November, 1917, to take up a private appointment in the Protectorate.

Mr. H. Simpson, Flax Instructor, arrived on the Farm in April and has done a large amount of travelling and beneficial work amongst the settlers in connection with the Flax industry. Private Cosmo Rose-Innes was acting clerk on the Farm until the 9th October, 1917.

Mr. J. D. Ritchie returned to the Farm on the 28th November, 1917, after being discharged from the Army as medically unfit for further service. He has been exceedingly busy getting books, records, etc., put into routine order once more.

I have the honour to be,
sir,
Your obedient servant,

J. JOHNSON,
Manager.

ANNUAL REPORT

FOR THE

Year ending 31st March, 1918.

DEPARTMENT OF AGRICULTURE,
NAIROBI EXPERIMENTAL FARM,
KABETE,
June, 1918.

THE HONOURABLE,
THE DIRECTOR OF AGRICULTURE,
NAIROBI.

Sir,

I have the honour to submit herewith my first annual report for the year ending on the 31st March, 1918.

I arrived in the Protectorate in the first week of April, 1917, and proceeded to Kabete Farm where I took over the duties of Flax Instructor.

During the period under review I made 52 visits in various districts, chiefly to those Farmers who are growing flax for fibre as well as for seed. These Farmers were anxious to be instructed in the handling and preparation of flax-straw for fibre manufacture. Instructions were given on the selection and cleaning of seed and harvesting and retting of straw. I also gave demonstrations in the handling and scutching of straw for the production of the highest possible percentage of flax fibre.

While on my visit to the Uasin Gishu Plateau I scutched different samples of straw. Two of these gave 20% of fibre and one above 20%.

I have dealt with numerous samples of seed and straw sent by different Settlers for inspection, treatment and report.

The following experiments have been carried out on Kabete Farm during the year.

1. Five acres planted at the rate of 60 lbs., of seed to the acre, in the last week of April—sown chiefly for seed production and harvested in the middle of August, 1917, yielded 2 tons, 5 cwts., of dry straw with seed. After threshing, cleaning and retting, the following was obtained:—595 lbs., of cleaned seed per acre and 3,920 lbs., of dry retted straw per acre. A sample of this straw yielded 16% of flax fibre and 8% of tow. This fibre, although a little coarse in quality, is of long staple and fairly strong.

The rainfall over this period was—20.07″ in 50 days.

2. Five acres were planted on the 26th April, at the rate of 60 lbs., of seed to the acre, and harvested towards the end of August, 1917. Growth was very good up to the latter end of July when the crop was laid down by the rains and did not regain its position.

About two acres of this plot was unfortunately mixed up with Bombay flax seed which is only used for cattle feed.

The remainder of the plot yielded 2,020 lbs., of cleaned seed.

Owing to having been laid by the rains and not ripening out properly the straw was of an inferior quality and yielded only 10% of fibre.

This fibre is weak and of poor quality.

The rainfall during this period was—20.51″ on 51 days.

3. One acre, grown from seed from the Uasin Gishu Plateau. This plot was sown two weeks later than that of Nos. 1 and 2, and harvested during the last week of August, 1917.

Germination of the seed was good and the growth of the flax straw finer in quality. This was probably due to the smallness of the seed sown although seeding was only at the rate of 50 lbs., to the acre.

Owing to the rains continuing late on in the season this crop had to be pulled before the seed was properly ripe and before the straw had completed its growth. Nevertheless the crop, for flax fibre purposes. was a very nice one.

The yield was—450 lbs.. of cleaned seed and 3,803 lbs., of dry retted straw. This straw gave 17½% of fibre of a long staple and much finer in quality than lot No. 1.

The rainfall over this period was—14.19″ on 33 days.

During the short rains. a two-acre plot was planted at the rate of 60 lbs., of seed to the acre. on the 25th October. The crop grew out very well for the first few weeks until the drought set in causing some of it to die off.

Flowering was uneven and the straw was too short to be of any use as fibre. The yield of seed was very poor.

In the Nursery 25 small plots were planted in order to experiment with wheat in the following season. These plots were also a failure owing to the drought.

4,865 lbs., of seed have been disposed of during the year and a balance of 1,460 lbs., remains on hand at the end of the year.

Training of Natives.

Several of the Reformatory boys and Kavirondo apprentices have been trained to the various branches of flax work while a good many natives have been sent to the farm by different Settlers in the Protectorate.

Machinery.

Up to the present I had no machinery for scutching flax except a small pedal machine for demonstration purposes. I hope however, to have a small factory of five scutchers running shortly.

At several of the Flax Factories which I visited a second time I was pleased to find that my instructions were being carried out and that my method of treating and handling the flax straw had been adopted.

It is also gratifying to note that the Settlers are keen to accept any advice or assistance offered.

I have the honour to be,
sir,
Your obedient servant,

HUGH SIMPSON.
Flax Instructor.

ANNUAL REPORT

OF THE

Mycologist

FOR THE

Year ending 31st March, 1918.

THE HON. THE DIRECTOR OF AGRICULTURE,

NAIROBI.

Sir,

Herewith my Annual Report as Mycologist for the year ending March 31st, 1918.

General.

On my return from leave on 4th April, 1917, I was at once engaged with a number of pathological problems commencing with diseases of Sisal and Coffee, and later with Forest trees both native and exotic, Citrus and Maize.

Nearly all these were caused either by Bacteria or Fungi, and with the exception of sisal proved serious.

The very damp climatic conditions of the latter half of 1916 continuing to September 1917, were eminently favourable to the development and rapid spread of Fungi and Bacteria both parasitic and saprophytic.

In addition to the actual laboratory work involved in these problems, much time was occupied in correspondence, and with no technical assistance, it was found impossible to work out the full course of the diseases investigated.

It is therefore earnestly hoped that the new laboratory for Mycological work which has been planned and recommended, will materialise during the course of the year.

Assistants both technical and clerical are also greatly needed, the former to take charge of the experimental work of the laboratory when I am away from headquarters, and also when I am on leave; and the latter to index journals and periodicals containing papers dealing with plant pathology, to keep careful records of observations in connection with diseases and to type reports, pamphlets, leaflets, and ordinary correspondence which has greatly increased

The need of a technical assistant or of an assistant who can be trained to do technical work is emphasised by the fact that, (1) no selection work was undertaken regarding the experimental wheats at Kabete during my absence on leave neither did they receive that care and attention in the matter of storage which such valuable material demands, and (2) during the same period and also while I was away on the Uasin Gishu Plateau for two months, the Botanic gardens including the experimental patch of coffee, were much neglected. Further during the latter period most of my cultures of disease organisms and laboratory experiments in connection with the investigation of certain diseases, were spoilt for want of attention and had to be discarded.

This naturally involved loss of time and a certain amount of material both of which could have been avoided had an assistant been in charge.

The lack of any suitable ground on which the many and various plants of economic importance could be grown for infection and control experiments in close proximity to the present laboratory, was keenly felt when working at such new diseases as the *Phoma* of coffee the circular leaf-spot of citrus, rot in maize, and the three diseases which broke out in Forest Plantations.

It is hoped that such ground will be available shortly, when the necessary work can be commenced with a view to discovering the pathogenicity of the various organisms isolated in the above diseases. Such experiments are essential in working out the course and control of hitherto unrecorded diseases; and even with well, known maladies which have been long known in other countries, it remains to ascertain whether or not the control measures which have been adopted are of any avail here.

There are a number of diseases whose symptoms are quite well known, but the actual cause of which has not yet been established; such for instance is the mal-di-goma of citrus (described below), die-back of coffee, bud-rot of the coconut palm. Until such diseases are investigated thoroughly whereby the actual causative organisms are discovered and the etiology of the disease worked out, control measures can only be of an empirical nature, and in such cases, usually takes the form of a blind and unintelligent attempt to apply some variety of fungicide in the hope that some good may come of it.

During the year many visits were paid to various plantations, but particularly to those of coffee in the absence of Mr. Trench who was away on active service.

In November and December an extended tour of the Uasin Gishu Plateau including part of the Trans Nzoia and Elgon was undertaken in connection with wheat and coffee. As detailed reports were submitted at the time on both these subjects they are not referred to at any length here.

Sisal.

The wet and warm weather of the first six months of the year brought about three diseases of sisal which were investigated both in the field and in the laboratory.

Sisal has always been regarded as very highly resistant if not immune to fungous diseases but the present experience has shown that under certain favourable conditions this plant may be subject to the attacks of both bacteria and a parasitic fungus. The three diseases investigated were as follows. (1) the well-known red-blotch which has made its appearance from time to time whenever the rains have been heavy and continuous over a long period. This is a physiological disease and is not due to any specific organism as has been proved in a very complete manner by the Germans in their former East African territory. They were able to reproduce similar blotches on both surfaces of the leaves by covering up portions with damp paper or cloth proving that temperature and moisture play an important role in this phenomenon.

So far no remedy for this trouble is known and although a most unsightly appearance is exhibited by the plants attacked, and the fibre of such may be considerably shortened, yet the total number of plants affected is not great and the damage on the whole is very slight.

The fact that only some plants are affected and others are not seems to indicate a certain immunity or resistance in some, and on the other hand a susceptibility in others.

It would be well worth trying the experiments of planting out only suckers from the resistant variety, if this were possible, but seeing that the disease only makes its appearance at long intervals (so far) it is not easy to know which are susceptible, and which resistant varieties. However, as the susceptible variety is known for this season it might be possible to exclude their suckers from future planting.

A yellow blotch made its appearance which produced gumming of the leaves and which rendered the fibres incapable of perfect decortication. This disease did not prove very serious as but few plants were affected. The cause of the trouble was probably due to bacteria, as a bacillus was isolated from the gummy yellowish blotches which, when placed upon the surface of pieces of fresh leaves contained in damp chambers, produced a very similar but not quite identical yellowish gum-exuding blotch. It was not possible to carry out any detailed work on the organism or to endeavour to make any more elaborate infection experiments.

Specimens of leaves were also submitted to the laboratory which bore round light spots here and there on both surfaces. As the specimens were kept under observation for some time the unaffected tissues gradually darkened and dried up leaving the spots a lighter colour and so making them more prominent. On

these spots after some time, were produced the fructifications of the fungus which appear as small dark erumpent pustules arranged in circles.

Microscopical examination showed that the spots were due to a species of the genus *Colletotrichum* all the known members of which are parasitic.

That this particular species of *Colletotrichum* is parasitic upon sisal was indicated by the fact that soon after the specimens arrived in the laboratory, two healthy sisal leaves which had been sent in from Kabete for the purposes of comparison exhibited the characteristic spots of the fungus.

These fresh leaves had evidently become infected by the spores of the *Colletotrichum* floating about in the air of the laboratory. The parasite limits its attention to the epidermis and cortex as do the other members of the genus, and does not damage the fibres; the disease has not proved serious and probably like the two diseases described above becomes conspicuous only under extremely wet conditions.

Maize.

Various diseases of maize were recorded and investigated. The maize rust *Puccinia sorghi* was much more prevalent this year than formerly and caused a good deal of damage to the leaves.

The most serious trouble was caused by a bacterial rot either of the stems or of the leaves, which chiefly affected the young maize plants of 2-3 feet in height, causing the stems to fall over and eventually to die. The final stages were accompanied by a rather bad smell recalling that of the coconut bud-rot disease.

It is probable that in this instance two diseases were concerned for in most cases investigated either the stems were affected and not the leaves, or, the leaves only were attacked, the stems remaining quite sound.

As in most cases when herbaceous annual plants suffer from bacterial diseases nothing can be done to save them, and hence this trouble did not receive any detailed investigation.

Two rots of the cobs were observed, one red and the other yellow, which were found to be due to various mould fungi. Only certain varieties of white maize were attacked; but particularly those with very thick axes, and also those which had previously grown in another part of the country.

For the above three diseases there is obviously one very clear remedy and that is the planting of resistant varieties. There are various types of white maize in the United States which exhibit different degrees of resistance to *Puccinia sorghi* and also to various bacterial diseases.

Further it has been proved by some of the Settlers of the Uasin Gishu Plateau that the yellow varieties of maize are very resistant to all the diseases described above.

Nearly all the white maize grown upon the Plateau and Trans-Nzoia in 1917 suffered very severely from one or all of these diseases, whereas the yellow varieties were scarcely affected and yielded an excellent crop.

From the point of view of resistance to disease, and heavy cropping powers the yellow variety has much to recommend itself, and in the writer's opinion it seems possible that such desirable characters could be bred into a white maize.

The question is one for the plant breeder; for the character of yellowness and all that it includes can be probably segregated from that of resistance to disease by the Mendelian method, just as the characters of beardedness and resistance to rust were segregated in the case of wheat.

Disease in Forest Plantations.

During the year three serious diseases were reported by the Forestry Department in two plantations in which a number of trees very quickly died.

The trees attacked were (1) a certain variety of gum tree (Eucalyptus microcorys) (2) a species of *Araucaria* and (3) seedlings of M'hogo (Brachylaena hutchinsi).

The cases of Eucalyptus and Araucaria although they occurred in different plantations were very similar and commenced by a general wilting of the foliage which very soon turned yellow but remained attached to the twigs. At this stage the stems and branches were found to be devoid of any sap, and further investigation showed that the trees had suffered from the invasion of a fungous mycelium which had gained entrance in the neighbourhood of the roots, and was spreading up the trunks of the trees. The cambium layer was killed and completely occupied by a thick white mycelium which had also killed the cortex but so far had not invaded the wood to any great extent. The general appearance of the mycelium indicated that it probably belonged to one of the higher fungi—the Basidiomycetes—the fructifications of which are the well known mushrooms, toad-stools, and bracket fungi. In the cases, however, of the Eucalyptus and Araucaria no fructifications were discovered, neither were the characteristic rhizomorphs of the dreaded honey agaric—*Armillaria mellea*.

It is extremely probable that fructifications will be formed later when it will be possigle to identify the organism; but the absence of rhizomorphs exclude the possibility of a species of an *Armillaria* being the cause of the disease.

The fungus has most likely spread from the stumps of old trees which have been left when the original forest was cleared to make room for the plantations, and helps to emphasise the great importance of *thorough* clearing particularly on forest soil.

The surest means of control would be to collect and burn any fructifications which may appear, and to trench round the affected trees, or to trench an area including all those already attacked. These measures would tend to lessen the risk of spore infection and also that from spreading underground mycelium.

In the third case, the m'hogo trees were young seedlings about a year old and not more than 2-3 feet in height, which were also discovered to wilt and die off. Examination showed that the bases of these small trees including the junction of the chief roots with the stem, were infested by a whitish mycelium and that upon the surface, and imbedded in the soil adhering to the bark, were small black *Sclerotia*.

These black bodies of irregular shape and varying in size from a large pin's head to a small pea are the well known rusting stages of the genus *Sclerotinia* some of which have two forms of fructifications. A number of the Sclerotia were collected and brought into the laboratory, where they were kept under different conditions. Four or five months afterwards a few of them commenced to produce a higher form of frutification, namely, Apothecia which when fully developed will enable me to make a determination of the organism. It is most likely that this *Sclerotinia* is a native of Africa, though it is also quite possible that it may have been imported with seed of gum or wattle.

The life history of *Sclerotinia* is of economic importance, as the black sclerotia fall from their hosts and remain in the soil for some considerable time, after which they produce spore bearing organs in the form of the Apothecia. It is then that danger arises, for if plants susceptible to the attacks of Sclerotinia are planted in this soil they are almost certain to become infected with the fungus. Such soil containing sclerotia should not be planted for at least two seasons.

Coffee.

(1) Coffee Leaf Disease.—*Hemileia vastatrix*.

The leaf disease (*Hemileia vastatrix*) was much in evidence, and spread to plantations which hitherto had been free from the disease. Thus many of the Thika plantations were attacked for the first time during the end of the long rains (June-July 1917), and Limoru also was visited, though at this altitude the presence of the disease was recorded and no more.

It is worthy of note that the Kyambu District which has had leaf disease for some years lies between Limoru and Thika, and it is evidently from the former district that the latter two have become infected.

In the Nairobi area no serious damage resulted from the presence of *Hemileia* on well cared for plantations, but on those which for one reason or another had been neglected and were either buried in long grass weeds, and needed pruning, or had been allowed to bear heavy crop, Hemileia was very severe and caused much of the crop to blacken off and a good deal of die-back to ensue.

Hemileia vastatrix was found during a visit paid to the Uasin Gishu Plateau, the Trans-Nzoia and Elgon though to a very slight extent, which is in accordance with other observations recorded

for a number of years at lower levels which indicate that the virulence of *Hemileia vastatrix* is dependant upon the altitude, *i.e.*, coffee grown at high altitudes (over 6,500 feet) is very much less susceptible to the parasite than is that at lower levels.

The native Nandi coffee was attacked very severely at the Experimental Farm Kabete in 1917 which in my opinion throws some light on the origin of the disease on cultivated coffee in this country. Up till now it has been generally understood that this variety of coffee was not attacked by, or was at least highly resistant to *Hemileia vastatrix*. The case of the Nandi coffee at Kabete, however, shows that this variety is quite susceptible to the disease under certain conditions, amongst which may be included that of neglect. In this case the parasite spread from Mocha coffee on to the Nandi variety, but in all probability if sufficient search were to be made in its natural haunt it would be found that the Nandi coffee is already infected, although perhaps but slightly, in its natural state. It has been known for some time that the wild coffee native of Uganda (*i.e.*, C. robusta) is the source of the disease in that country, and it seems reasonable to suppose that the Uasin Gishu Plateau coffee and that of the Trans-Nzoia has been infected from the wild Nandi variety.

(2) Leaf and Berry Spot Disease.—*Cercospora coffeicola.*

The leaf spot disease has spread considerably since it was first recorded for this country in 1913. Probably, like many other fungous diseases which are always present though often unnoticed, an epidemic breaks out whenever conditions climatic and otherwise, become favourable to its rapid spread. Such conditions were realised in 1917 during and after the abnormal rains, Hitherto this disease has confined its attentions to a few leaves, but his year the ripening berries were also attacked in large numbers. As a detailed account of this disease is to be issued shortly in leaflet form, a brief description of the disease and its control will suffice for the present report.

This spot disease is caused by the parasitic fungus *Cercospora coffeicola* and has been recorded on coffee in this Protectorate and in Uganda for a number of years. On the leaves are produced dark brown to black circular spots which in older specimens possess a decided greyish centre. The same spots are formed on the ripening berries, but in this case they are sunken a little below the surface of the pulp. The spots both on the leaves and berries increase in size and become somewhat irregular in outline, but are easily recognised by the prestnce of the grey centre.

The portion of the berry attacked loses its flesh and becomes sunken and shrivelled causing the skin to adhere tightly to the kernels so that it cannot be removed by the pulping machine.

In South America this is a very serious disease, the leaves berries, and in addition, the young shoots are all attacked. Up to the present, however, I have only discovered the parasite upon the leaves and berries and not on the shoots.

There is no doubt, that in another abnormally long rainy season, much damage will be done to the berries, and it is quite possible that the young shoots will also become attacked.

This parasite, however, yields without difficulty to spraying, and the same strength of Bordeaux mixture which is used to control *Hemileia vastatrix* is suitable to deal with the Cercospora *coffeicola*, *i.e.*, 2 lbs. copper sulphate to 40 gallons.

(3) The Stem Disease.—*Phoma sp.*

Due to the same climatic conditions is the appearance of a new fungous disease of coffee caused by a species of *Phoma*. As a leaflet has been already published with reference to this disease it is only briefly mentioned here.

Suffice it to say that this organism is to be found to a slight extent on most coffee trees over 4 years old where it inhabits the bark scales, and under normal conditions is not a parasite.

During the heavy and prolonged rains of 1916-1917 it became actively parasitic and in some manner as yet undiscovered invaded the tips of the very young shoots either the apical one, or a very young primary close to it. Once having gained an entrance the mycelium spread rapidly down the stem between the bark and the wood, destroying the cambium layer in advance. The bark was killed almost at once, but the wood was not invaded until later, and hence the foliage was able to receive water from the roots for some time after the death of the outer tissues.

It was in fact possible to find a tree perfectly healthy in all outward appearances the cortex and bark of which were quite dead, all sap and green colouring matter having disappeared, for a distance extending in some cases, to half way down the tree.

Later on when the mycelium of the fungus invaded the wood and so cut off the water supply to the foilage, the latter quickly wilted and the whole tree commenced to die from above downwards. The mycelium was traced in the final stages deep into the roots. At this stage the bark of the upper part of the stem becomes covered with a mass of the fructifications of the fungus which consists of very numerous and very small receptacles known as Pycnidia imbedded deep in the bark but having a small orifice to the exterior.

When these are hamped either artificially or by rain or dew, the contents of very minute spores are extruded in the form of a rope-like coil and soon become scattered by wind and rain.

The exact mode by which the fungus gains an entrance to the host tissues is not yet clear and needs further investigation. A prolonged damp atmosphere is undoubtedly necessary and wounds caused either by insects or in some other way afford a ready entrance to the germinating spores.

Further where lightning has struck coffee plantations patches of trees nearly always die sooner or later where the lightning has struck, and on examination are found to be infected by the *Phoma*.

If infected trees are recognised in the early stages, which can be done by peeling away a little of the bark and observing whether or not the cortex is discoloured black or brown, they can be saved from total destruction by stumping to within 8 to 12 inches of the ground level, *i.e.*, well below the area of discoloured cortex. It has also been found possible to protect adequately the surrounding trees by spraying with Bordeaux or Carbide mixtures containing 2 lbs., copper sulphate in 40 gallons.

This serious and fatal disease was completely checked by stumping and spraying and ceased as soon as the rains were over and dry weather had set in. It is quite likely, however, to make its appearance in another rainy season especially on ill-cared for plantations.

The life history and particularly the mode of entrance of the parasite, needs further research for its complete and satisfactory elucidation.

From the foregoing remarks two things become evident, (1) the necessity for most careful and thorough cultivation of coffee, including the cleaning of the soil and the proper pruning of the trees, (2) the desirability for general spraying at least twice a year to be undertaken by all coffee planters.

The cost and trouble of spraying a plantation are not so immense as might at first be imagined. In spraying for the Phoma disease in 1917 on one particular plantation a "dairy-maid" pump and bucket machine was the only apparatus available, and water had to be carried on native's head for the distance of one mile. Yet by employing 6 natives with this one machine, 40 acres of three year old coffee were sprayed twice in a month with the carbide mixture, two paraffin tins full of carbide being used up in the preparation of the spraying mixture.

One hundred acres of coffee require 1,000 lbs., of copper sulphate and about twice that amount of local lime for one spraying of Bordeaux mixture of strength 2 lbs., to 40 gallons.

(4) Leaf Curl.

During the year a curious leaf curl made its appearance on coffee all over the Protectorate. The young expanding leaves were mal-formed, much crinkled and brittle when touched. The irregular edges of the curled portion were brown and dead, and from these was isolated a species of *Cladosporium* growing saprophytically upon the dead tissue.

Further observations showed that the shoots which produced these mal-formed leaves threw out perfectly normal leaves after some time so that such a shoot had perfectly formed leaves from the apex downwards and then one or two older ones which presented the curled and bitten appearance. It was further noticed that on the side exposed to the prevailing winds (Easterly) more leaf curl appeared than on the sheltered side of the trees, and that no leaf curl existed on the tree close up to and under the wind breaks. This was particularly noticeable on exposed plantations such as occur in certain parts of Limoru, Ngong, on the Uasin Gishu Plateau and on the Trans-Nzoia.

The trouble is no doubt due to exposure to strong winds at high altitudes, and indicate the desirability of planting many and sufficient wind breaks on all exposed slopes upon which coffee is grown.

While visiting coffee plantations on the slopes of Elgon a very good natural example of the value of shade to coffee at high altitudes was observed on the Rongai river. In this particular coffee plantation which had been planted along the river bank, a few of the large flat-topped acacia trees which are found at elevations of 6,500 feet and over, had been left here and there among the coffee.

The coffee trees immediately beneath the shade of the acacias were large, healthy, and dark green in colour, whilst the remainder growing in the open presented a stunted, unhealthy and yellowish appearance.

It is true that shade is likely to lessen the crop, but on the other hand it will probably become more regular, and this in itself is a much desired state of affairs, for the tendency at the present time is to force the trees to bear enormous crops with the result, that the plants cannot stand the strain and die-back and severe damage from *Hemileia*, and other parasites are the invevitable result.

The observations of the past five years regarding the districts susceptible to fungous diseases in coffee indicate that the higher the altitude at which the coffee grows the less is it subject to fungous attacks.

Many of the plantations in the Limoru District are nearly 7,000 feet above sea level and the rainfall (55 inches) is considerably above that of the Kyambu and other lower lying coffee districts (Ngong-Thika) yet very little disease is known in the district . Even during the long wet period above referred to *Hemileia vastatrix* was very scarce; a few cases of *Phoma* were recorded, and none of *Cercospora coffeicola*.

The explanation is probably due to the fact that although the rainfall is greater at Limoru yet at such an altitude the atmosphere is relatively drier than it is at lower levels, in other words the humidity of the Limoru area is lower than that at Kyambu, etc.

Citrus.

(1) Leaf Diseases.

The undetermined disease of oranges and lemons was again prevalent in some districts. This was investigated in 1915, and the conclusion then reached was that it was a form of *Colletotrichum gloeosporiodes*, which causes the Wither-tip, leaf—and fruit—spot of oranges and lemons. In 1915 the disease was successfully controlled by experiments carried out by this Department in the Thika District and at the Government Farm Kabete, which showed that any strong fungicide would check the spread of the parasite and if continued would prevent infection altogether.

Since that time the disease has been investigated from time to time as opportunities have arisen with the result that it is now clear two diseases have been confounded under one name. They are the Wither-tip and spot disease referred to above due to the parasitic fungus *C. gloeosporiodes*, and a new leaf spot disease of the leaves of oranges and lemons which take the form of dark brown, raised concentric rings. These rings are very numerous and cover most of the older leaves causing them to fall prematurely with consequent detriment to the forming of fruit.

All attempts so far at isolating and so determining the parasite at work, have failed, chiefly because it has been impossible to devote sufficient time to such a problem, and also because the laboratory facilities for such work are far from adequate.

(2) Nectria Disease.

A species of *Nectria* was discovered on the branches of some specimens sent from Njoro where a small patch of lemons had died. Spraying would probably prevent the spread of this disease.

(3) Canker.

During the year much information was received from South Africa and from the United States regarding the Citrus canker disease which has of late caused enormous loss among Citrus growers in Florida. Steps were immediately taken to prohibit the importation of all foreign stocks whatever into the Protectorate, and at the same time as opportunity arose, citrus trees were examined to ascertain if the organism causing the disease were already in the country.

The canker was in fact, reported from up-country by an American settler who stated he knew the diasease well in Florida and had recognised it in a mild form on some oranges in this country.

Upon investigation it was discovered that there exists in the country a certain disease on oranges and possibly on lemons which bears a resemblance to the canker of South Africa.

The disease does not seem to spread, and so few leaves are attacked that no damage has so far resulted.

This particular trouble is very apt to be confounded with the scab of sour lemons, so often seen on sour lemon stock. For some years these two diseases were thought to be the same both in the United States and in South Africa.

They may be distinguished, however, by the fact that the scab generally attacks the sour lemons, and covers the leaves with very numerous, irregularly shaped corky pustules, whereas the canker is found chiefly on orange, lemon, and grape fruit and the spots on the leaves are nearly rounded with corky margins and hollow centres.

In Florida and South Africa the trees attacked by canker have very numerous spots, not only on the leaves, but also upon the fruits and young shoots, but in this country the spots have been noticed very occasionally only on a few of the leaves.

From these spots no parasitic fungus could be found, but a bacillus was isolated which agreed in many points with that lately found in South Africa to be the cause of the canker disease. As the facilities do not yet exist for carrying out careful bacteriological work it has not been possible to discover all the characters of the organism involved which are necessary for its identification; in other words it has not been possible to repeat the work carried out in South Africa on the identification of this bacillus, and hence it cannot be definitely stated that the South African organism and that isolated in British East Africa are identical or only similar. If it could once be proved that the two are identical then it would be evident that the disease here is neither so virulent nor so dangerous as in other countries.

The point is an important one as it is of the greatest use to know the distribution of any given disease, and to be able to recognise the variations which it undergoes under the different conditions existing in other countries.

(4) Mal-di-Goma or Foot Rot.

The disease known as Mal-di-goma or foot rot was investigated for the first time in January 1918. The trouble has been recorded before by Mr. Adams who reported that he had come across one or two slight cases up-country.

Soon after Mr. Adams had left the Department, however, the disease was again reported which led to as thorough an investigation of the matter as was possible under the circumstances.

This disease attacks the base of the tree including portions of the roots just below the ground level, causing at first, a copious gumming, and later a drying and cracking of the bark and cortex on one side. This spreads around the stem which finally becomes completely ringed and the death of the tree soon follows.

The process takes some time and usually some 18 months elapse between the first signs of gumming and the death of the tree. Mal-di-goma is always preceded by a heavy crop, after which gumming appears. Whenever citrus trees, especially lemons, which appear to be more susceptible in this country, produce abnormally large crops, this disease should be suspected and investigations as to the conditions of the base of the tree at once instituted.

The only remedy so far known is, firstly to lay bare to the action of sun and air that part of the stems which is just below ground including the commencement of the root system.

Secondly, the gumming portion of the stems and that which has died and cracked must be completely cut out with a sharp knife so as to expose the wood and the surrounding green and healthy cortex. Finally the cut surfaces must be painted over with a disinfectant such as carbolic acid made up of one part carbolic mixed with one part of water, or any other standard disinfectant such as Jeyes fluid or Lysol, to which an equal volume of water has first of all been added.

This operation should be performed as soon as ever gumming is noticed and not left until the tissues die, and the cracking of the bark sets in, for the longer it is postponed the greater is the risk that the stem will become entirely ringed, when nothing will save the tree.

The cause of the Foot-rot of citrus is not definitely known; insanitary conditions resulting from soil which is liable to become water-logged is no doubt a predisposing factor, as is also non-cultivation. These predisposing causes render the trees liable to the attacks of some organism about which there has been a good deal of discussion and uncertainty for many years.

The fungus known as *Fusarium limonis* is always associated with the disease, and is accused of being the direct cause of the trouble in a number of text books on the diseases of citrus. This organism was found to be present and was isolated from the specimens of the diseased trees submitted to the Department for investigation.

There is, however, no clear proof that *Fusarium limonis* is parasitic upon citrus, for no satisfactory infection experiments have yet been performed, and there is at present no evidence to show that this organism is not purely saprophytic in its mode of existence.

I was able to carry out a little work myself on the investigation of the causative organism, *i.e.*, upon the organism which causes the gumming and final death of the tissues, and the conclusions to which I came were as follows:—(1) although *Fusarium limonis* is present on tissue exhibiting typical lesions of the Foot-rot it nevertheless functons as a saprophyte and lives on the already dead and dying tissues. (2) the gumming and death of the stems is probably due to the action of bacteria which were observed in large numbers in the cortical cells of the affected parts. A bacillus was isolated from these which agreed in its general character with those of the bacteria which are known to bring about diseases of other plants.

As before, lack of facilities necessary for such work put an end to further investigation of the matter and the subject had to be dropped. It was not even possible to carry out infection experiments to ascertain whether or not the isolated organisms could produce a disease at all, and no detailed study of the bacillus, such as is necessary for its determination, could be undertaken.

Wheat.

Experimental.

I regret to report that no experimental work was carried out during the year under review, owing to the fact that most of my time was fully occupied by pathological work.

In spite of drawbacks and the remarkably heavy and long rains in 1917 the wheat at Kabete produced excellent results, particularly the large field trials of Hybrids No. 11 (early Rieti X Red Fife) and No. 13 (Egyptian No. 3 X Nut Cut). Among other proved characters which these selections possess can now be added that of strong straw, for in spite of the heavy rains which fell upon these two, no lodging resulted.

A little rust in a few patches was discovered in No. 13, while No. 11 showed hardly any.

The following is a report received from Messrs. Unga, Ltd., in 1915 of the milling qualities of No. 13.

"*Appearance.* The wheat received appears to be a very good milling quality, and rather above medium strength. When threshed the weight per bushel is 62½ lbs. which indicate a wheat well matured and quite suitable for milling.

Milling. This wheat mills very well and gives a fairly clean bran. The flour is granular and lively, but rather yellow in colour. The colour would be greatly improved if the wheat were milled on a really high-class milling plant.

Baking. We send you herewith a loaf baked from flour. The crust has a good colour and the bread is palatable; the texture of the crum is very fair but not so fine as from a high-class flour.

The only defect we would note is the rather dark colour, but this as previously stated is not altogether the fault of the wheat.

We would say that the flour, for bread making purposes, is better than Indian Superfine.

Yours faithfully,
JOHN G. BRYDEN,
Manager."

So far there has never been enough grain over for a proper milling and baking test to be made of No. 11, as all of this selection except that which was actually needed for sowing at Kabete, was disposed of. It is hoped, however, that it will be possible to have a test made as the result of the October harvest 1918.

As in previous years (1913 onwards) these two varieties No. 11 and No. 13 have again given very good results as regards yield and resistance to rust. Very promising reports have been received from the Trans Nzoia and from the Nandi Border where these two wheats have been grown with success for the last two years.

In my opinion the wheat fields of Golden Ball, Equator, Zwaartbard, and Kabete hybrids of the Uasin Gishu Plateau and Trans Nzoia districts are not to be surpassed in clean cultivation, appearance, or in yield, anywhere in the Protectorate.

Some very excellent wheat as regards resistance to rust and yield was grown at Njoro and neighbourhood. The majority of wheat one sees growing in this district is not of good appearance, as it is a mixture of many types originating no doubt from the 350 varieties which were once grown at Lord Delamere's Equator Farm, at Njoro.

The long season May-October, 1917, proved a decided success in the matter of wheat growing at Kabete, but the short season November, 1917-March, 1918 was somewhat of a failure owing to the almost total absence of rain. However, enough grain was produced to carry on the field trials and nursery plots. Several samples sown in the breeding cage came to nothing.

The following wheats were sown at Kabete during 1917:—

(1) Field trials.

1. Hybrid No. 11 (Early Rieti × Red Fife) 12 ac.
2. Hybrid No. 13 (Egyptian No. 3 × Nut Cut) 12 ac.

(2) Nursery Plots.

1. Hybrid No. 13 (from previous field trial).
2. ,, ,, 13/5 (Egyptian 3 × Nut Cut).
3. ,, ,, 11 (from previous field trial).
4. ,, ,, 10 × (Early Rieti × Thew).
5. ,, ,, 10/2 (Early Reiti × Thew).
6. ,, ,, 10/7 (Early Reiti × Thew).
7. ,, ,, 10/9 (Early Reiti × Thew).
8. ,, ,, 4/4 (Rieti × Thew).
9. ,, ,, 12/1 (Egyptian 3 × Yellow fife).
10. ,, ,, 15/1 (Egyptian 3 × Thew).
11. Warren.
12. Indian No. 17.
13. No name, No. 1.
14. No name, No. 2.

(3) Breeding cage.

The same wheats as the preceding with the addition of the following:—

1. 11/b (Rieti × Thew).
2. 11/3 (Rieti × Thew).
3. 11 (Rieti × Thew).
4. Egyptian No. 5 (early maturing and drought resisting).
5. Nonette de Lausanne.
6. Neapoliton.
7. Madonna.

Flax.

A disease of the stems of flax plants has to be recorded. The specimens investigated came from the Experimental Farm, Kabete, the Manager of which reported that a large field of flax, which had been allowed to ripen for seed, had developed long dark patches on the stems. It was further reported that the affected flax stems were quite brittle at these spots.

Investigations carried out in the laboratory soon revealed the fact that the black elongated areas on the stems were due to a fungus, the mycelium of which had penetrated the epidermis and had attacked and destroyed the best fibres of the cortex which form the fibre of commerce.

In cultures of diseased pieces of flax stem set up in damp chambers, the fructifications of the fungus were rapidly produced. Microscopical examination of these proved that the organism was a species of the genus *Macrosporium*, all the members of which are known to be parasites.

As stated above the disease made its appearance in flax plants nearly ripe for seed and long past the stage of pulling for fibre; but occasionally here and there in the same field younger plants had sprung up which were also slightly attacked.

It remains to be seen whether a field of young flax intended for fibre is attacked, or whether the *Macrosporium* is only able to exist upon quite mature plants on the point of death. Should the former prove the case the disease might be very serious in a wet season and means will have to be devised for ridding the seed of fibre-flax from adhering spores of this fungus.

The spores of *Macrosporium* are produced at the same time as the seeds of the flax ripen, and it could be inevitable that the seeds and spores would be distributed together.

So far, however, no further outbreak has been recorded from Kabete, although I have myself seen up country flax ripe for seed bearing the same disease. This seems to indicate that the disease is one of age and that the stems are attacked only when their powers of resistance are on the wane and the plant having produced its seeds is about to die naturally.

The Botanic Garden.

This garden, which occupies the grounds of the old Provincial Commissioner's residence on Ainsworth Hill is making but slow progress owing to the unsatisfactory nature of the labour employed; but nevertheless is now taking shape.

The ornamental shrubs and trees which Mr. Powell and the writer planted in 1915 have grown very well, and begin to give a distinct suggestion of a botanical garden to the place. A few plants have succumbed to the drought of 1917-1918, and arrangements have been made to replace the misses. Except along the river bank the whole area has now been cleared of blue gums and bush, and most of the open ground has been put under Uganda Grass (*Cynodon dactylon*).

It is once more urged, as in a previous report, that a permanent staff such as the Arboretum possesses, may be sanctioned for employment at this very promising garden. The few convicts which are available from time to time to keep the place fairly clean can by no stretch of the imagination, be considered as gardeners and until a proper gang of shamba boys is engaged the development must necessarily be slow. A head boy obtained

from the Arboretum is already installed, but he cannot do all that is required by himself, and the gang of convicts which occasionally works there is not enthusiastic about carrying out his instructions.

Owing to the fact that the bungalow on the premises is not occupied by an officer of the Agricultural Department, the place was very much neglected during my absence on leave in 1916-1917. The experimental patch of coffee was particularly in need of attention as it had neither been cultivated nor pruned for some time, and leaf disease, which careful attention and spraying had eradicated two years previously, had again made its appearance and covered most of the trees.

On my return, however, a gang of convicts was soon forthcoming, the coffee was cleaned and pruned, and after receiving two applications of Bordeaux mixture of strength 2 lbs. to 40 gallons the disease was checked and finally controlled.

Herbarium and Literature.

With the help of a temporary clerk which was granted for the last 3 months of the year, it was found possible to pay some attention to the herbarium.

Some 600 plants, the duplicates of which have been sent and partly named by the Royal Gardens, Kew, have now been suitably mounted and arranged in order in the herbarium cabinet. It is hoped that with further assistance this collection will be greatly enlarged. The knowledge of the habitat and distribution of wild and native plants is of great importance from the point of view of the outbreak and spread of disease; for the greater portion of the native flora acts as suitable hosts for parasitic fungi which under favourable conditions are liable to spread to plants of economic importance.

It has also been possible to index and catalogue the most recent literature on Mycology and plant pathology, the need for which has long been felt, and now that it has been commenced it is hoped that the necessary permanent assistance will be provided to keep this work up-to-date.

The importance of this clerical work cannot be exaggerated. for in order to possess a knowledge of the latest developments in the subjects of plant pathology, embracing as it does, not only the life histories of the parasitic fungi, but also the control of plant diseases, it is necessary to have at one's disposal all the most important journals dealing with the subject. Since these are many and written in more than one language a considerable portion of one's time is occupied in digesting the latest work from various countries, and for the purposes of future reference it is absolutely essential that such papers which touch any part of the subjects should be at once carefully recorded and indexed under some suitable system.

Noxious Weeds. (*Carduns chamaecephalus*).

In February, 1918, I investigated the spread of a certain thistle which had been reported from the Limoru District as encroaching very rapidly upon pasture land. A detailed account of this was submitted at the time and it will only be necessary to state here the conclusions to which I came.

The thistle has no stem, but lies flat on the ground, surrounded by a rosette of large prickly leaves, and was first recorded by Schimper in 1870 who collected it in the highlands of Abyssinia. It is a native of the highlands of North and East Africa and has been named *Carduns chamaecephalus*, which means the thistle with its head on the ground. Its distribution is not constant; but varies slightly, advancing and receding, and does not permanently occupy any one piece of ground. Thus in 1904 Mr. Battiscombe found it at Limboru Station, and in 1918 the writer found no sign of it at this place, but some 3 miles to the eastward advancing towards the spot it had occupied in 1904. It can only be destroyed by digging out, but a great deal of protection from re-invasion can be obtained by wind-breaks.

I am, sir,
Your obedient servant,

W. J. DOWSON,
Mycologist.

ANNUAL REPORT

OF THE

Coffee Plant Inspector

FOR THE

Year ending 31st March, 1918.

AGRICULTURAL DEPARTMENT,
NAIROBI,
April 10th, 1918.

THE HON. THE DIRECTOR OF AGRICULTURE,
NAIROBI.

Sir,

I have the honour to submit my report for the year ending 31st March, 1918.

During the year I was absent on Active Service from the 27th April to 27th November, 1917.

From the 1st to 26th April, 1917, I inspected three farms in Kyambu and wrote up reports on plantations I visited earlier in the year.

Since resuming my duties as Coffee Plant Inspector on November 28th, I have visited 55 plantations in various districts.

April, 1917, to 31st March, 1918:—

District.	No. of plantations inspected.	Total No. of visits.	Acreages. 1–3, 3–6, 6–on.	Total.
Kyambu ...	14	16	427½, 789½, 390	1607
Fort Ternan ...	9	9	313 , 179 , ...	492
Kericho ...	9	9	112¾, 139⅜, ⅛	252½
Sotik ...	9	9	118¾, 44¼, ...	163
Lumbwa ...	3	3	146 , 52 , ...	198
Nyeri ...	7	7	459 , 83 , 11	553
Thika ...	1	1	... , 165 , ...	165
Limuru ...	1	1	Inspecting Coffee Machinery.	
Ngong ...	1	1	... , 470 , ...	470
Nairobi and Parklands ...	4	4	2 , 2¾, 1¼	5
Total ...	58	60	1579 , 1925⅛, 401⅜,	3905½

Since my arrival in the Protectorate on first appointment I have made complete inspections in the following districts: Nyeri, Songhor, Koru, Fort Ternan, Lumbwa, Sotik, Thika, and various plots around Nairobi.

During your absence in South Africa, I had arranged to leave Nairobi on the 11th January to visit the Plateau, but this was postponed as the Mycologist had only recently returned from a tour through this area. On the 14th January I left Nairobi for Fort Ternan, Lumbwa, Kericho and Sotik.

Thrips have been very bad this season, and have caused considerable damage. Not only will there be a decrease in the crop, but in several instances plantations are likely to suffer heavily from loss of trees. Most of the planters are manuring the affected areas with cattle and goat manure, which treatment will be beneficial to the trees and will in a great measure restore them to their former condition more quickly.

As soon as the rains commence the insects will gradually disappear, and the trees slightly affected will recover rapidly.

Thrips appears to do most damage on sheltered areas, in valleys to leeward of the plantation or in the vicinity of windbreaks.

Antestia.

These were bad in parts of Kyambu last April. The parasite supplied by the Government Entomologist was very effective, and were found on several plantations that were affected with this bug.

Phoma.

In the early part of last year there was an outbreak of Phoma on two plantations in Kyambu, which the Government Mycologist investigated.

Cutworms are still very bad in the Nyeri district, and there and in other districts that I have visited the planters have been taking precautions against the pest by setting poison bait; wrapping shields around the stems of the young plants and searching for the grub.

The Leaf-Minor Moth is also bad at Nyeri and although it is stated that this pest does not do any material damage to the plants it gives the plantation a very unsightly appearance.

Out of the fifty-eight plantations inspected I reported on twenty-three as having the Leaf Disease. One plantation in particular in Fort Ternan was infected very badly and up to the time of my visit no spraying had been carried out; the result was most of the trees were almost denuded of their foliage.

I was surprised to see how well the coffee looked, on the whole, in Kericho, considering the high altitude. The growth is slow and the prevalence of hail-storms is certainly a drawback; nevertheless I am of opinion that shading would greatly help to overcome most of this difficulty.

Out of the nine plantations inspected in Sotik, three farms practically make up the acreage of coffee under cultivation. I noticed only one tree infected with Leaf Disease and a few cases of Brown Scab. Frequent hailstorms are the chief drawback to the planters.

GENERAL.

The "Blue Mountain" and "Mocha" varieties, species of "*C. Arabica*" are the two most commonly grown in the Protectorate.

The chief disadvantage of having these planted in the same field is, the Blue Mountain (which is always in minority) has a much larger berry and in the process of pulping the berries get cut and broken, as the pulper is generally set to take the average size of the "Mocha" berry.

In appearance the "Blue Mountain" type appears to be a sturdier plant, but the yield is smaller. In conclusion, I am of the opinion that the Coffee Industry of this country has a good future and this Protectorate will eventually become one of the most important coffee countries.

Fungoid diseases and insect pests will always be to a certain extent a handicap to the grower, but with proper care and attention I do not consider that they should cause any alarm.

Thrips undoubtedly is the most serious pest to be dealt with, but under normal and favourable conditions no extensive damage will be done to plantations. There is still a great deal of improvement required in pruning, selection of seed, planting and "handling" of the crop.

I have received several requests from owners of coffee plantations to give an early visit to their property. I am giving precedence to these, together with owners on Active Service.

I have the honour to be,
Sir,
Your obedient servant,

ARTHUR LE POER TRENCH.
Coffee Plant Inspector.

ANNUAL REPORT

OF THE

Veterinary Division

for the year,

1917-18.

OFFICE OF THE CHIEF VETERINARY OFFICER,
NAIROBI,
April 29th, 1918.

THE HON. THE DIRECTOR OF AGRICULTURE,
NAIROBI.

Sir,

ANNUAL REPORT OF THE VETERINARY DIVISION

FOR THE YEAR 1917-18.

I have the honour to submit the annual report of the Veterinary Division for the year 1917-18.

It is to be regretted that, owing to the large number of Veterinary Officers on Active Service, the division has been unable to deal with outbreaks of stock diseases in the native reserves where, in some cases, the losses suffered have been heavy. Every effort has been made, however, to deal with outbreaks in the European settled areas and to keep the main transport routes open to traffic. The results obtained reflect great credit on the small Veterinary staff which was availabe to carry out these duties.

I have the honour to be,
Sir,
Your obedient servant,
W. KENNEDY.
Acting Chief Veterinary Officer.

Personnel.

The Chief Veterinary Officer, Lt. Col. R. J. Stordy, D.S.O., proceeded on leave to England on April 10th, 1917, and has since been seconded for duty to the Army Veterinary Corps.

The Deputy Chief Veterinary Officer, Mr. W. Kennedy, was released from Military service on August 13th and reverted to Civil duty as Acting Chief Veterinary Officer.

The following Veterinary Officers were released from Military service and reverted to their Civil duties on the dates shown:—

R. Edmondson	...	July 14th.
O. Dixon, m.c.	...	October 6th.
A. W. Carter	...	July 14th.
T. C. Bradshaw	...	July 14th.
M. H. Reid	...	September 28th.

The following Veterinary Officers were on Active Service throughout the year:—

A. G. Doherty, m.c. (Major d.a.d.r., e.a.e.f.).

H. H. Brassey-Edwards (Major e.a.v.c.).

F. J. McCall, m.c. (Major e.a.v.c., a.d.v.s.).

R. C. Wheeler (Capt. e.a.v.c. (a.v.c., s.r.)).

W. W. Henderson (Capt. e.a.v.c. (a.v.c., s.r.)).

G. N. Hall (Capt. e.a.v.c.).

F. J. S. Sheedy (Capt. Adjt. e.a.v.c.).

Dr. Hannigan was appointed temporarily to a post in the Veterinary Division with effect from July 14th.

Mr. J. B. Banks, Permit Officer, was released from Military service and resumed his civil duties with effect from November 6th. Since that date this officer has also carried out the duties of Registrar of Brands.

Clerical Staff.

Mr. J. W. Johnson has been on active service throughout the year. Mr. R. L. O'Shea was appointed to fill a vacancy with effect from July 14th. Mr. A. Walker, of the Laboratory staff, was released from Military service on July 14th and was employed at the Headquarters Office until September 7th when he returned to his usual duties at the Laboratory.

Mrs. Elliott was employed as Typist from July 6th to December 22nd and Miss Cottare was employed in a similar capacity from May 10th.

Livestock Inspectors.

Mr. H. Branwhite was on Active Service throughout the year. The following Inspectors were on duty for the periods shown:—

H. G. Ulyate, during the whole year.

E. E. Bladen-Taylor, during the whole year.

J. Kempe, from 1st April, 1917 to 19th July, 1917.

G. M. McDonell, from 12th June, 1917 to 31st October, 1917.

H. W. Ievers, from 15th June, 1917.

T. Harris, from 26th June, 1917 to 1st December, 1917.

J. P. Englebrecht, from 17th July, 1917.

E. Bessler, from 14th August, 1917 to 20th March, 1918.

D. Wyartt, from 20th December, 1917.

C. E. Simmons, from 27th December, 1917.

Indian Veterinary Assistants.

Veterinary Assistant Khalil-ul-Rahman was on station throughout the year. Mohamed Ramzan was released from Military service on May 21st and Seyd Gulam Hassan on July 14th.

During the absence of the Assistant Veterinary Pathologist (Mr. W. Kearney) on leave and when the Veterinary Pathologist (Mr. R. E. Montgomery) left the service of the Protectorate to take up the post of Director of Veterinary Research, Union of South Africa, Mr. T. C. Bradshaw, Veterinary Officer, was appointed Acting Assistant to the Veterinary Pathologist.

DISEASES OF CATTLE.

East Coast Fever.

During the period under review cases of East Coast Fever occurred on several farms, hitherto free of the disease, in the Nakuru District. An outbreak also occurred in the Limoru clean area involving three farms. In the Naivasha Quarantine area, in February, two cases occurred in a herd of cattle which had been permitted to move from an infected area under the Dipping Rules. The remaining cattle were promptly removed by rail from the clean area and precautions were taken to prevent the further spread of the disease. In consequence of this outbreak it has been decided to suspend the dipping rules until such time as more Veterinary staff is available to supervise cattle dipping throughout the infected areas.

East Coast Fever has spread considerably in the Masai Reserve during the year.

This is largely, if not entirely attributable to the movement of large herds of slaughter cattle purchased from all parts of this densely stocked area to meet the Military requirements.

The extension of East Coast Fever in the European settled areas during the past four years has mainly occurred through the illicit movement of cattle from infected areas. Contributory causes were the lack of dipping tanks and the scarcity of immune oxen as a result of the war.

In October the new boundaries of the areas infected with East Coast Fever were gazetted together with the rules governing the movement of livestock throughout the Protectorate.

The Kamiti Testing area was closed down in May as the number of cattle produced for testing did not justify the employment of a Stock Inspector to supervise it. During April and May two cattle died on the area and thirty-two were released and branded as immune to East Coast Fever.

During the year fourteen dipping tanks were inspected by Engineers of the Public Works Department and eleven of these were passed as built in accordance with the Government Plan and Specification. A public dipping tank was built by the Government at Naivasha in March and two others are in course of construction at Machakos and Londiani.

The decrease in the number of private dipping tanks erected during the year is attributable to the high price of cement and, to overcome this difficulty, several stock owners have decided to erect tanks constructed of timber. The Public Works Department has prepared a booklet containing much valuable information on the best methods of building dipping tanks constructed of concrete, stone or timber and this should prove of great assistance to stock owners and contractors. A pamphlet on cattle dipping will also be published shortly by the Veterinary Division.

The following information with regard to the analyses of dip samples has been kindly supplied by the Government Analyst:—

For the year ending 31st December, 1917, the total number of dip samples analysed was 1,223 as compared with 984 last year and 650 in 1915.The results of the analyses were as follows:—

	1915	1916.	1917.
Percentage within 10% of correct strength ...	54.5	58.8	52.9
Percentage seriously wrong (from 11% to 20% out) ...	25.7	22.3	26.1
Percentage dangerously wrong (more than 20% out) ...	19.8	18.9	21

From the marked increase in the number of dip samples submitted for analysis during the year one would have expected that stock owners would have experienced less difficulty in keeping the strength of their dips constant; the results, however, show that a smaller percentage of dip samples were of correct strength than in previous years.

In December, owing to pressure of work and lack of staff, the Government Analyst was compelled to ask stock owners to send dip samples once a month only with the result that the number of samples analysed promptly dropped by quite fifty per cent.

Rinderpest.

This disease was the cause of exceptionally heavy losses during the year. Extensive outbreaks occurred amongst native-owned cattle in the Province of Tanaland and in the Nandi, Machakos, Kenya and Masai Reserves. From the Nandi Machakos and Kenya Reserves the disease spread to European farms in the Uasin Gishu, Lumbwa, Nyeri, Fort Hall, Ulu, Nairobi and Kyambu Districts. Isolated outbreaks occurred at Ravine and at the Kabete Government form. The Ravine outbreak was successfully dealt with by the use of serum only. At the Kabete Government farm 700 head of cattle were double inoculated with a loss of 1.6%.

Nyanza Province.

Owing to the spread of Rinderpest in the Nandi Native Reserve this district was placed in quarantine in April. A Veterinary Officer visited the infected area in May and reported that the disease had nearly died out. Towards the end of April an outbreak occurred on farms near the Nandi border, in the Uasin Gishu district, and it was thought that the infection had been carried from the Nandi Reserve through the natives trading in diseased meat. As a number of wild pigs were reported to be dying along the Nandi border about the same time it is possible that these animals also played a part in the dissemination of the disease. In dealing with this outbreak serum only was used as, owing to the heavy rains, it was feared that the mortality resulting from double inoculation would be exceptionally high. By the end of June the Veterinary Officer-in-charge of the outbreak reported that he had it well in hand. During August and September, however, the disease appeared on twelve more farms and the outbreak was not stamped out until October. In July and August oribi and wild pigs were reported to have died on some farms about ten days before Rinderpest appeared among the cattle and it was thought that these animals were largely responsible for the spread of the disease. This is the first time that oribi have been reported in this country as suffering from Rinderpest. Upwards of 13,000 doses of anti-rinderpest serum were used in dealing with the Uasin Gishu outbreak and, although no accurate figures are available, it would appear that the losses, especially among young stock, were heavy. The climatic conditions, as already mentioned, were bad and few stock owners could provide shelter even for their calves.

Double inoculations against Rinderpest were carried out in the Koru district in October when 185 head of cattle were dealt with.

An outbreak of Rinderpest occurred in the Songhor district in February and 3,756 cattle were double inoculated in that area in March.

Tanaland Province.

Rinderpest was first reported on the Tana River in October 1916. In October 1917 it was again reported to be causing heavy losses in the Upper Tana district and the game was reported to be dying of it. No Veterinary Officer was available to attend to this outbreak. The Provincial Commissioner, Tanaland, estimates that the value of the cattle lost through this outbreak approximated £250,000. It appears to be highly probable that Rinderpest spread from the Upper Tana to the Kenya Province if not also to the Ukamba Province.

Kenya Province.

The first outbreak which came under notice in this Province occurred in the Native Reserve, Fort Hall district, in May. A Veterinary Officer investigated the outbreak in June and made arrangements for all non-immune transport oxen in the area to be given serum every fourteen days. Rinderpest was reported to be existent in the neighbouring district of Embu at the same time but did not cause serious losses. Owing to the lack of staff double inoculations were not carried out.

In November and December the District Commissioner at Nyeri and Embu reported that several buffaloes had been found dead in their districts and in January a severe outbreak of Rinderpest occurred amongst native-owned cattle in the Embu district. Wild pigs were also reported to have died in large numbers. during February and March Rinderpest spread from Embu to the Fort Hall and Meru districts and the losses have been considerable.

Rinderpest appeared on a few European farms in the Thika area, Fort Hall district, in October. A Veterinary Officer was detailed to take charge of the outbreak and about 5,000 head of cattle, including the majority of the transport oxen using the Thika-Fort Hall-Nyeri road, were double inoculated. Infection in this case was probably introduced from the Machakos Native Reserve by Squatters' or trade stock.

An outbreak occurred at Nyeri in January and 500 head of cattle were double inoculated there during January and February.

Ukamba Province.

Rinderpest was first reported in the Machakos district early in September and, between September and December, practically all the cattle on the European farms in the neighbourhood of the outbreak as well as the transport oxen using the area—in all, 3,330 head of cattle—were double inoculated.

The disease spread from the Machakos Reserve to Squatters' cattle on a farm in the Donyo Sabuk area, in February, necessitating the double inoculation of 385 cattle there.

Outbreaks occurred in the Nairobi East Township and in the Kyambu district in December, January and February. The infection was probably introduced from the Machakos district in the first instance through the illicit movement of cattle intended for slaughter. Nine hundred and eight head of cattle were double inoculated in connection with these outbreaks.

Rinderpest was reported to be prevalent in the Kitui district in November but when the district was visited in January by a Veterinary Officer no trace of the disease could be found. The transport oxen working between Kitui and Machakos were double inoculated.

Masai Reserve.

Several villages were reported to be infected in the Masai Reserve in August. No accurate figures of the losses were obtainable but it was stated that all cattle up to two years old were affected. Heavy losses from this disease were again reported in November and an outbreak occurred in the Narok district in January when it was stated that in certain villages, nearly all the calves had died. In February reports were received that Buffaloes (mainly calves) and wild pigs were dying in considerable numbers in the Reserve.

The present position with regard to Rinderpest is briefly as follows:—

Rinderpest has been stamped out in the European settled areas and all transport oxen working between the clean and infected areas have been actively immunized. Until such time, however, as a sufficiently large Veterinary staff can be provided to eradicate the disease in the infected Native Reserves, there will always be a danger of its reintroduction to the settled areas through illicit movement of cattle or through trading in diseased meat. At present the Machakos, Kenya and Masai Reserves and the Meru district are infected areas. In the Native Reserves of the Nyanza Province and along the Abyssinian border in the vicinity of Moyale, Rinderpest may be regarded as enzootic.

During the period under review 22,962 head of cattle, the property of settlers, squatters and transport riders, and 8,374 cattle, the property of the Military authorities were double inoculated against Rinderpest. Owing to the shortage of staff it was not always possible to detail a Veterinary Officer to enquire into the losses following inoculation but, so far as can be ascertained, the losses seldom exceeded four per cent. and in the majority of cases were below this figure. Redwater and Anaplasmosis were found to be accountable for over five per cent. of the losses on a farm where a loss of ten per cent. was experienced. On another farm a loss of twenty per cent. occurred but the cause of this exceptionally heavy mortality could not be ascertained.

Rinderpest Quarantine Stations were opened at Kipkarren (Nandi-Uasin Gishu border) and at Machakos during the year in order to allow of cattle being brought out of the infected areas of Machakos and Nandi.

In November the Chief Veterinary Officer, Uganda Protectorate, applied for the services of one Veterinary Officer and two Stock Inspectors to assist in checking the spread of Rinderpest in that Protectorate but the required assistance could not be given.

Pleuro-Pneumonia.

This disease spread considerably in the Masai Reserve during the year and two outbreaks occurred on farms near Nairobi in March and June, 1917. One hundred and eighty-one head of cattle were slaughtered in suppressing these outbreaks which apparently resulted from illicit movement of cattle from the Masai Reserve boundary.

In April a Stock Inspector visited the Kajiado-Kiu area, Masai Reserve, and reported that, of 21 manyattas inspected, six were infected with Pleuro-pneumonia. From this area the disease spread to the Ol Aitokitok location (towards Kilimanjaro) in October. In September the Political Officer, Aruscha, reported that an outbreak had occurred at Ketumbeine (German East Africa) about forty miles across the border.

The Acting Assistant Veterinary Pathologist (Mr. Bradshaw) was transferred to the Masai Reserve in August for duty in connection with the investigation of Pleuro-pneumonia. The details of his investigations will be included in the report of the Acting Veterinary Pathologist.

I proceeded to Narok in September to consult the Officer-in-charge, Masai Reserve, with regard to measures to be adopted with a view to eradicating this disease. It was then estimated that there were upwards of three quarters of a million head of cattle in the Reserve and that if inoculations were to be undertaken and carried out efficiently, a staff of at least eight Veterinary Officers and fifty Stock Inspectors would be required.

The Acting Veterinary Pathologist put forward proposals in September for the establishment of a branch Veterinary Laboratory in the Reserve for the investigation of Pleuro-pneumonia and other stock diseases prevalent there. Sanction to erect this Laboratory was obtained in October and the building is now in course of construction.

In October, the Military Abattoir in the Masai Reserve was moved from Mbagathi to near Athi River Station from which place the meat supplies for the troops in Nairobi are forwarded by rail daily.

Arrangements have now been completed for the meat supplies for the civil population in Nairobi to come from the Masai Reserve also.

FOOT AND MOUTH DISEASE.

Out breaks of this disease occurred in March and April 1917 on farms at Gilgil and Kinangop in the Naivasha district. The history of these outbreaks pointed to the disease having been introduced by a herd of trade cattle brought from the Northern Frontier district and sold at Naivasha on the 10th of March. This suspicion was confirmed when information was received in June to the effect that the main stock route from the Northern Frontier was infected between Archer's Post and Rumuruti. Somali cattle traders state that Foot and mouth Disease (Som. Abeb) is prevalent in Jubaland.

On the farm at Gilgil where the disease first appeared there were about 900 head of cattle and 400 pigs. During the first month the disease spread rapidly amongst the cattle and upwards of 350 head became affected. No cases occurred in pigs. All the affected cattle showed typical mouth lesions but foot lesions were not observed, although several cattle were noticed to move with a stiff gait resembling that of an animal suffering from laminitis. Loss of condition was marked, especially in grade cattle, and milk secretion was practically suspended. Quarantine was raised from this farm on May 26th.

In the Kinangop outbreak the cattle were not badly affected, but the disease spread to a herd of 72 pigs, a number of which developed foot lesions and took a considerable time to recover. Quarantine was raised on June 1st.

The outbreak near Rumuruti was first noticed in a herd of cattle purchased by the Military Authorities in the Northern Frontier District for slaughter purposes. Subsequently the disease was reported to be prevalent among Samburu cattle along the stock route and this stock route was closed until December 1st.

In June the Officer-in-Charge, Masai Reserve, reported that Foot and Mouth Disease was well known to the Masai, who term it "Ol Kirobi." A Military Veterinary Officer, who was purchasing donkeys in the Masai Reserve at that time, was requested to report if any cases of the disease came under his notice, but nothing further transpired until February, when the disease was reported to be prevalent in the Reserve. This report was confirmed by a Veterinary Officer, and, although no cases have come under notice in sheep, it was deemed advisable to prohibit the export of sheep and goats from the infected area.

ANTHRAX.

Twenty-five cases of Anthrax occurred amongst cattle in the Nairobi and Kyambu Districts during the year. In one case a farmer carried out a post mortem examination and afterwards gave the meat to the natives on the farm, with the result that he and several natives contracted the disease, but fortunately they all recovered.

Other outbreaks were reported from the following places, and the diagnosis was confirmed at the Veterinary Laboratory:— Machakos, Thika, Limoru, Escarpment, Elmenteita, Nakaru, Molu, Koru and Songhor.

An outbreak of disease which occurred in April amongst kongoni (haartebeeste) in the game reserve, near Nairobi, was diagnosed by the Veterinary Pathologist as Anthrax.

Reports of Anthrax were received from the Masai Reserve in April, June, September and November and in some cases natives were reported to have died of the disease. A Stock Inspector contracted Anthrax in February while inspecting hides in the Masai Reserve. He promptly obtained medical attention and made a good recovery.

In January the Medical Authorities reported outbreaks of Anthrax on the Upper Tana River (Tanaland) and on the Marsabit-Archer's Post road (Northern Frontier District). A number of natives died during these outbreaks as the result of eating the flesh of infected carcases.

TRYPANOSOMIASES.

At the beginning of the year two farms in the Thika area, Fort Hall District, were in quarantine for Trypanosomiases. A Veterinary Officer was detailed to inspect the cattle on these farms in October and again in December, when moist blood films from all the cattle were examined microscopically with negative results. In view of these findings, quarantine was raised in January.

BLACKWATER (*Quarter Evil*).

Cases of this disease occurred on farms in the Naivasha, Nakaru, Lumbwa and Ulu Districts. The Veterinary Laboratory issued 21,590 doses of Blackquarter vaccine during the year.

CONTAGIOUS ABORTION.

This disease has been fully dealt with in previous reports and there is nothing of note to record this year.

ANAPLASMOSIS AND REDWATER.

These diseases came under notice chiefly in connection with the double inoculation of cattle against Rinderpest and, until a supply of cattle, which have been regularly dipped from birth, is obtainable for the production of the virulent rinderpest blood required for these inoculations, losses from Redwater and Anaplasmosis must be anticipated, particularly in herds which have been regularly dipped.

When double inoculations were carried out at Koru in October the virulent blood was obtained from an animal, thought to have been regularly dipped from birth, and which had been infected with Rinderpest by contact. In spite of these precautions a loss of nearly 40% occurred from Redwater on one farm after inoculation.

General.

Heavy losses have been reported to have occurred among cattle in the Koru-Songhor District. On one farm alone 34 deaths occurred in one month in a herd of 556. The symptoms and the appearance of the carcases after death resembled those of Anthrax but all specimens forwarded to the Veterinary Laboratory for examination gave negative results. Young stock were chiefly affected and inoculation with blackquarter vaccine appeared to check the spread of the disease. Efforts are being made to elucidate the cause.

A peculiar cattle disease came under notice in the Kedong Valley in August. The symptoms were similar to those seen in cattle suffering from Trypanosomiases but no trypanosomes could be detected microscopically and inoculations carried out at the Veterinary Laboratory with blood from sick cattle gave negative results. No evidence was obtainable that the disease was infectious or contagious. Several deaths occurred and in October the owner was advised to move the remainder of his herd to higher ground at Escarpment. In February the owner reported that all his cattle, with the exception of one cow, had recovered completely. The administration of Arsenic in doses of 5 grains daily appeared to have a marked beneficial effect. This disease appears to be similar to "Nakuruitis," a condition noticed among cattle grazed for any length of time near Nakuru, and from which the cattle spontaneously recover when moved to the Solai or Rongai neighbourhood.

Another peculiar condition came under notice in the Ulu District in 1917. The disease has only been reported as affecting cattle and is prevalent in the Machakos Native Reserve, where it has caused considerable losses. It is thought to be caused through cattle eating a poisonous plant, but this has not been proved so far. Mr. Dixon, Veterinary Officer, had an opportunity of observing five cases of the disease and reports as follows:—

Mothiooko (*Turning Sickness*).

"This disease which, according to the natives, first made its appearance in the latter part of 1916, is now reported to be widespread in the Machakos Reserve and the losses have been considerable. Only five cases actually came under my notice. The clinical symptoms develop suddenly and are as follows:—

"The pupils of the eyes are widely dilated. The animal moves in a circle (all cases seen by me turned to the left); the gait is that of a blind beast and the animal eventually goes down. In fatal cases the head is drawn on to the left flank and remains in that position until death occurs. Obstinate constipation was noticed in all the cases and the temperatures were normal until shortly before death. Post mortem examination showed impaction of the omasum, great distension of the gall bladder, with normal bile and biliary congestion of the liver.

"The treatment adopted was the administration of ½ oz. Muriatic Acid in 20 ozs. of water followed two hours later by a dose of Epsom Salts (1½ lbs.). Two of the cases recovered."

This disease is also reported to be prevalent in the Meru District.

Several cases of Streptoth-ricosis came under notice during the year in cattle. This condition will be fully dealt with in the report of the Acting Veterinary Pathologist.

DISEASES OF EQUINES.

Horsesickness.

Fourteen deaths from Horsesickness were reported by Veterinary Officers in Nairobi during the year. A few cases were also reported to have occurred in the outlying districts, but it would appear that the losses from this disease have been less than in previous years.

Epizootic and Ulcerative Lymphangitis.

The following list shows the number of cases of these diseases which came under notice during the year:—

	Epizootic.	Ulcerative.
Nairobi	20	27
Machakos	1	1
Nyeri	1	0
Fort Hall	2	1
Ravine	1	0
Uasin Gishu	1	7
Lumbwa	0	1
Sotik	0	2
Total ...	26	39

Twenty cases of Ulcerative Lymphangitis were treated with vaccine in the Nairobi Quarantine Station during the year; of these, eight recovered, ten died and two are still under treatment. Dipping at seven day intervals in cattle dipping fluid of three day strength appeared to act as an efficient preventive and, in some cases, effected cures.

Ten cases of Epizootic Lymphangitis were treated with Potassium Iodide: one recovered, two died, four were sent to the Veterinary Laboratory and three are still under treatment.

Glanders.

No case of this disease came under notice during the year.

DISEASES OF SHEEP AND GOATS.

As stated in previous reports sheep and goats Scab, Strongylosis (wire-worm), foot-rot, Nairobi Sheep Disease, and contagious (caprine) Pleuro-pneumonia are prevalent in practically all the native reserves.

Strongylosis is the cause of considerable loss to European sheep farmers in the Protectorate and, as excellent results have been obtained in South Africa with a remedy issued by the Veterinary Research Laboratory, Pretoria, experiments have been undertaken to ascertain if this remedy can be administered with safety to local sheep in the doses recommended in South Africa.

DISEASES OF THE PIG.

Swine Fever.

Outbreaks of this disease were reported during the year at Limoru, Parklands (Nairobi) and on the Uashin Gishu Plateau. The mortality ranged from 50% to 100%.

DISEASES OF POULTRY.

During the past year Kikuyu Fowl Disease has been very prevalent in the Nairobi and Kyambu Districts and has caused heavy losses.

A vaccine for use against this disease was issued by the Veterinary Laboratory and used with good results.

One outbreak of Epithelioma Contagiosa came under notice in Nairobi.

GENERAL.

Livestock Importations.

The following list shows the number of animals landed at the Ports of Kilindini and Mombasa during the past two years:—

	1916-17	1917-18
Horses	5	1
Mules	6	3
Donkeys	498	431
Cattle	573	845
Camels	0	15
Sheep and Goats	666	1546
Pigs	3	25
Poultry	64	73
Dogs	20	17

Over 700 head of cattle were imported from the Uganda Protectorate during the period under review.

Since the outbreak of War the following animals were cast by the Military Remount Department and sold in the Protectorate:—Horses, 414; mules, 78; donkeys, 3.

Trade Stock.

The numbers of cattle, sheep, goats, horses and mules brought from the Northern Frontier District and Jubaland and passed through the Rumuruti Quarantine Station during the past three years are as follows:—

	1915-16	1916-17	1917-18
Cattle	8964	3358	6581
Sheep and goats ...	7812	405	1403
Ponies and Mules ...	515	912	450(about)
Donkeys	94	0	0

The numbers of cattle which were double inoculated against Rinderpest at the Muhoroni Quarantine Station during the past two years are as follows:—

	1916-17	1917-18
Trade cattle	5062	8246
Military Cattle	5838	8374
Total ...	10900	16620

During the last three months, 1,810 head of cattle were inoculated and passed through the new quarantine station established at Kipkarren, on the Nandi-Uasin Gishu border.

The total revenue accruing from testing, dipping and inoculation fees amounted to Rs. 52,500 for the year as compared with Rs. 43,864 last year.

Meat Inspection.

The numbers of carcases inspected at the Nairobi Abattoir were as folows:—

	No. inspected.	No. condemned.
Cattle	3,015	111
Sheep and Goats ...	20,194	28
Pigs	976	1
Game	85	4

Cattle were chiefly condemned on account of East Coast Fever and "Measles"; sheep on account of emaciation and dropsy due to parasitic infections; game on account of "measles." The meat inspector reports that the dead weight of half-bred sheep averaged 45.50 lbs.—one carcase scaled as high as 105 lbs. These figures are interesting when it is considered that the average dead weight of native wethers is 25 lbs.

At Mombasa Abattoir, 2,620 cattle and 10,214 sheep and goats were slaughtered during the year.

Owing to the Veterinary quarantine restrictions and the demand for slaughter animals for the troops, there was a shortage of meat during the last few months in Nairobi. In consequence of this, arrangements were made to supply the Nairobi requirements from the Masai Reserve. Cattle and sheep are slaughtered on the confines of the reserve and the meat is transported to Nairobi by rail—a distance of about eighteen miles.

The Permit System.

This system has been in operation throughout the Protectorate for many years now and has proved of great assistance to the Veterinary Authorities in controlling the spread of disease. When an outbreak of disease occurs some time usually elapses before the condition is recognised to be an infectious one. During this interval, in most cases, movement of stock has taken place from the infected area and it is by means of the permit system that it is possible to trace such movement and so exert an efficient control over the outbreak.

The benefit which the stock-owning community derives from the permit system far outweighs any slight inconveniences which may be caused to the individual and it behoves every farmer in the Protectorate, therefore, to assist the Veterinary Authorities by reporting any breach of the regulations which may come under his notice.

It has been suggested during the year that permits should only be required when cattle are moved from one district to another. This suggestion cannot be entertained, however, until there is a sufficiently large Veterinary staff available to deal efficiently with the stock diseases in the various districts.

There are at present forty-three honorary Permit Issuers and the Administrative Officers, Police and Stock Inspectors also act as issuers of Permits.

The thanks of the Government and of the community at large are due to the first-named gentlemen for having undertaken these honorary duties.

During the year the following permits were issued at the Nairobi Permit Office alone:—

Cattle Permits	2,676
Sheep Permits	156
Pig Permits	27

Branding of Stock Ordinance.

During the year fifty brands were registered.

Owing to the general failure of the short rains grass has been exceptionally scarce since December and the situation was aggravated in January and February through grass fires occurring. In consequence of lack of grazing on the plains near Nairobi thousands of game came on to farms where the grazing had been

conserved, with the result that these farms were eaten bare. The cattle losses from starvation have been heavy not only in the native reserves but on European farms and it is to be hoped that losses from this cause will be guarded against in the future by growing root crops, making ensilage, etc.

In conclusion, I should like to record my best thanks to the members of the field and Laboratory staffs for the whole-hearted manner in which they have carried out their duties, under exceptionally difficult circumstances, during the past year.

W. KENNEDY,
Acting Chief Veterinary Officer.

ANNUAL REPORT

OF THE

Veterinary Pathologist,

East Africa Protectorate,

for the year,

1917-1918.

ACTING CHIEF VETERINARY OFFICER,
NAIROBI.

Sir,

I have the honour to submit the ninth Annual Report of this Laboratory for the year ending March 31st, 1918.

I regret to say that once again the Report does not contain as much matter of Public interest as is desirable. Owing to the lack of an adequate Professional Staff, and to the increased demands for Laboratory products, it has only been possible to deal with Research work at odd moments, and then only very lightly.

Practically our whole time during the year has been given to the preparation of Sera and Vaccines, the output of which, as will be seen later, shows a marked increase over former years. The production of Anti-Rinderpest Serum alone, for the Nyasaland Commission and for Military purposes, occupied the time of a large portion of our lay technical staff.

It is, however, gratifying to know that the Ex-Veterinary Pathologist, Mr. Montgomery, is compiling a comprehensive report on the work he has carried out in this country, and we can look forward to it for most interesting information. He is, I believe, covering all work done at the Laboratory from the time of its creation up to the date of his resignation in 1917.

The erection of a branch Laboratory in Masailand for the investigation of Pleuro-Pneumonia and other diseases in that reserve engaged Mr. Bradshaw's services for many months of the year, during which time I have been without professional assistance.

PERSONNEL.

VETERINARY PATHOLOGIST.

Mr. Montgomery handed over the duties of this post to Mr. Bradshaw in April, and on my return from home leave, and three month's course of study at the Pretoria Laboratory, I took over from Mr. Bradshaw on June 5th, 1917.

ASSISTANT VETERINARY PATHOLOGIST.

Mr. Bradshaw assumed the duties of this post on June 5th, 1917. On August 14th, 1917, he was detailed to investigate the nature of Bovine Pleuro-Pneumonia in the Masai Reserve, those duties being interrupted during November and December, when, through my detention in hospital, he was in charge at Kabete. He returned to Masailand in February, 1918.

CLERICAL STAFF.

Mr. Walker was released by the Military and returned to the Laboratory on September 7th, 1917.

Mr. Galway was seconded to the K.A.R.'s at the end of September, 1917.

Mr. Myers remained on duty throughout the year.

Mr. Bromhead was allowed to relinquish his temporary appointment in July, 1917.

LAY LABORATORY STAFF.

Mr. Schultz proceeded on short leave to South Africa on August 6th and returned on December 13th, 1917.

Mr. E. W. Gray returned from leave June 3rd, 1917.

Mr. J. Ford was transferred to Narok, to assist Mr. Bradshaw, on March 21st, 1918.

Mr. H. J. Gray has been on duty throughout the year.

Sergeant J. B. Cheshire, E.A.V.C., has been attached to the Laboratory since July 9th, 1917.

OVERSEER.

Mr. J. Burton has been in residence throughout the year.

YARD FOREMAN.

Mr. A. Wight remained on duty throughout the year.

STOREKEEPER.

Mr. J. Scott has been on duty throughout the year.

MECHANIC.

Corporal Coetze, S.A.V.C., returned to his Unit on June 6th, 1917, and Mr. G. Taylor assumed the duties of the post on June 12th, 1917.

Laboratory Students.

Mr. E. Bessler relinquished his appointment on August 10th, 1917, to take up the duties of temporary Stock Inspector.

Mr. W. Beaton was appointed on February 5th, 1918, and Mr. A. T. Goodwin on February 6th, 1918.

In June, 1917, Mr. T. Harris was engaged to take charge of our stock of healthy cattle at Athi River, and in the same month Mr. J. D. Hopcraft was appointed for similar duties at Naivasha.

Visiting Veterinary Officers.

Veterinary Officer Carter spent a short period at the Laboratory in December.

Veterinary Officer Dixon, M.C., arrived on February 14th, and has since been chiefly occupied in procuring a suitable virus for inoculation against Bovine Pleuro-Pneumonia. He has also helped me considerably in prosecuting technical and administrative duties, and to him I owe much gratitude.

A marked *esprit de corps* has existed amongst all members of the staff, who worked most loyally throughout the year, and to whom I extend my hearty thanks for their staunch support.

CORRESPONDENCE.

Inward letters and telegrams amounted to 4,224 and outward to 4,205—a total of 8,429 in all.

BUILDINGS AND LAND.

There were no buildings erected during the year.

Owing to the large increase in numbers of our livestock and the failure of the short rains in November, we have had a trying experience in the upkeep of animals. I persistently endeavoured to procure a portion of Native Reserve from the local authorities to relieve the situation, but without success. I, therefore, made arrangements to transfer animals which were not actually on experiment to Athi River and Naivasha. This and Mr. Douglas Cooper's kindness in allowing us to use a portion of his land, helped us through very considerably. We were also lucky in having a large supply of ensilage, hay, and other artificial food stuffs in stock, and in this connection I deem it of interest to insert an extract from a report of our Farm Overseer on the crops produced and issued by him during the year. In some instances the amounts issued are greater than produced during the year. This is accounted for by the fact that we had a stock of these foodstuffs on hand from the previous year.

CROPS PRODUCED ON FARM.

April 1st 1917—March 31st, 1918.

Crops.	Tons.	Cwts.	Qrs.	Lbs.	Size of Plot.
Rape ...	73	14	1	22	10 acres.
Broad Beans ...	...	7	1	13	Self sown, probably about one acre.
Broad Bean Straw ...	1	0	2	14	10 acres.
Turnip Roots ...	148	5	3	26	
Turnip Thinnings ...	42	3	3	8	
Green Lucerne ...	19	16	3	14	7 acres.
Lucerne Hay ...	1	7	3	12	
Green Maize ...	455	18	3	24	30 acres.
Oat Hay ...	31	11	0	12	12 acres
Horse Bean Seed ...	...	...	...	20	2 acres, rust destroyed this crop.
Green Vetch Forage	20	4	1	4	2½ acres.
Vetch Seed ...	...	...	...	5	
Sweet Potatoes ...	1	12	0	16	4 acres.
Sweet Potato Tops	19	19	3	16	
White Belgium Carrots ...	180	...	...	...	20 acres.

ISSUES OF FOODSTUFFS.

April 1st, 1917—March 31st, 1918.

	Laboratory.				Farm.				Grand Total.			
Crops.	Tons.	Cwts.	Qrs.	Lbs.	Tons.	Cwts.	Qrs.	Lbs.	Tons.	Cwts.	Qrs.	Lbs.
Mangold Wurzel ...	49	9	1	22	6	14	3	18	56	4	1	12
Vetch Forage ...	14	1	0	20	1	4	3	8	15	6	0	0
Oat Hay ...	6	19	3	12		Nil			6	19	3	12
Green Maize ...	90	16	1	21	7	6	2	15	98	3	0	8
Rape ...	54	4	3	26	27	15	0	5	82	0	0	3
Barley Gram ...		Nil			0	6	1	28	0	6	1	28
Maize Gram ...	3	2	1	26		Nil			3	2	1	26
Broad Beans ...	0	7	1	13		Nil			0	7	1	13
Broad Bean Straw ...		Nil			1	0	2	14	1	0	2	14
Sweet Potato Tops ...	43	19	3	1	34	9	1	24	78	9	0	25
Sweet Potatoes ...		Nil			1	12	0	16	1	12	0	16
Swede Turnips ...	113	15	0	20	34	10	3	6	148	5	3	26
Green Lucerne ...	19	16	3	14	0	9	2	9	20	6	1	23
Lucerne Hay ...	0	19	3	8		Nil			0	19	3	8
Carrots ...	71	10	4	8	9	8	1	16	80	19	0	24
Ensilage ...	303	13	2	8	54	5	3	18	357	19	1	26

Ensilage made April 1st, 1917 —March 31st, 1918.

Ensilage.	Tons.	Cwts.	Qrs.	Lbs.
	639	19	2	20

FOODSTUFFS AND SEED ON HAND,

MARCH 31ST, 1918.

Description.	*Tons.*	*Cwt.*	*Qrs.*	*Lbs.*	*Remarks.*
Carrots	96	—	—	—	Stock feed.
Oat Hay	24	11	0	14	,,
Ensilage	300	—	—	—	,,
Horse Bean	—	—	—	20	for seed purposes.
Vetch seed	—	—	—	5	,,

LIVESTOCK.

Species.	On Books March 31st, 1917.	Received during year.	Total for year.	Remaining on books March 31st, 1918
Horses	75	18	93	58
Mules	64	26	90	74
Donkeys	16	19	35	7
Cattle	431	892	1,323	735
Sheep	121	104	225	130
Goats	2	—	2	1
Pigs	29	38	67	19
Totals	738	1,097	1,835	1,024

EXAMINATION OF OUTSIDE SPECIMENS.

A total of 2,294 slides and specimens were received and reported on during the year. It is regrettable that the examination of the majority of those specimens had of necessity to be left to lay Assistants, as without professional aid I could not find time to more than check suspicious and positive returns.

The classification and diagnosis of the specimens are as follows:—

Horses.	Total examined	221
Anthrax	15	
Epizootic Lymphangitis	11	
Ulcerative Lymphangitis	40	
Suspicious Ulcerative Lymphangitis	3	
Trypanosomiasis	1	
Leucocytosis	1	
Streptothricosis	2	
Negative	154	

Mules.	Total examined	101
Epizootic Lymphangitis ...	22	
Suspicious Ulcerative Lymphangitis	4	
Ulcerative Lymphangitis ...	19	
Trypanosomiasis	2	
Negative	54	
Donkeys.	Total examined	16
Negative	16	
Bovines.	Total examined	1,778
Suspicious Anthrax	7	
Anthrax	30	
Anaplasmosis	6	
Suspicious Blackquarter ...	13	
Blackquarter	23	
Suspicious East Coast Fever ...	31	
East Coast Fever	325	
Trypanosomiasis	7	
Redwater	19	
Streptothricosis	8	
Septicaemia	1	
Tuberculosis	2	
Necrosis	3	
Coccidiosis	1	
Suspicious Contagious Abortion ...	26	
Contagious Abortion	23	
Pleuro-pneumonia	2	
Suspicious Pleuro-pneumonia ...	2	
East Coast Fever and Redwater ...	2	
Redwater and Anaplasmosis ...	1	
Wireworm	3	
Negative	1,263	
Sheep.	Total examined	25
Suspicious Heartwater ...	2	
Necrosis	1	
Septicaemia	1	
Suspicious Streptothricosis ...	1	
Streptothrocosis	1	
Negative	19	
Goats.	Total examined	2
Negative	2	

Pigs.	Total examined	18
Swine Fever ...	... 3	
Negative ...	... 15	
Dogs.	Total examined	29
Tick Fever ...	... 7	
Negatives ...	... 22	
Camels.	Total examined	1
Negative ...	... 1	
Turkeys.	Total examined	15
Kikuyu Fowl Disease ...	... 9	
Negative ...	... 6	
Fowls.	Total examined	64
Kikuyu Fowl Disease ...	... 37	
Perihepatitis and Pericarditis	... 1	
Tuberculosis ...	... 2	
Pericarditis and Sarcoma or Carcenoma ...	... 1	
Negative ...	... 23	
Gazelle.	Total examined	6
Anthrax ...	... 1	
Worms ...	... 5	
Kongoni.	Total examined	4
Anthrax ...	... 2	
Negative ...	... 2	
Eland.	Total examined	2
Rinderpest ...	... 1	
Suspicious Rinderpest ...	... 1	
Ostrich.	Total examined	1
Worms ...	... 1	
Rabbits.	Total examined	7
Negative ...	... 7	
Flies.	Total examined	2
Tabanidae ...	... 1	
Hippobosca ...	... 1	
Flora.	Total examined	2
	(Passed to Government Botanist for classification.)	

PRODUCTION OF SERA AND VACCINES.

A total of 465,443 doses of Anti Rinderpest Serum were manufactured during the year—an increase of 260,963 doses over the previous year.

There has again been a great demand for Colon Bacillosis Vaccine, and reports on its efficacy as a preventive of a common colon infection of young calves have been very satisfactory. 1947 doses have been issued to Stockowners.

The preparation and issues of Laboratory products are as follows:—

	Doses.
Anti Rinderpest Serum.	
Balance on hand last year	47,762
Manufactured during year	465,443
Returned	40,508
	553,713

Issued to	*Doses.*
Departmental and Administrative Offices ...	127,828
Military	69,488
Stock Owners	12,056
Other Countries	91,200
Total issued ...	300,572
Balance on hand, March 31st, 1918	253,141
	553,713

Colon Bacillosis Vaccine.

	Doses.
Balance remaining last year	359
Made during year	2,174
	2,533

	Doses.
Issued during year	1,947
Balance on hand	586
	2,533

Ulcerative Lymphangitis Vaccine.

	Doses.
Balance remaining last year...	232
Made during year	800
	1,032
Issued during year	900
Balance on hand	132
	1,032

Blackquarter Vaccine, Single.

	Doses.
Balance on hand last year	10,400
Made during year	9,640
	20,040
	Doses.
Issued during year	14,580
Balance on hand	5,460
	20,040

Blackquarter Vaccine Double, 1st Vaccine.

	Doses.
Balance on hand last year	Nil
Made during year	7,990
	7,990
	Doses.
Issued during year	7,010
Balance on hand	980
	7,990

Blackquarter Vaccine, Double, 2nd Vaccine.

	Doses.
Balance on hand last year	Nil
Made during year	5,940
	5,940
	Doses.
Issued during year	5,070
Balance on hand	870
	5,940

Bovine Trypanblue.

	Doses.
Balance on hand last year	69
Made during year	8
	77
	Doses.
Issued during year	72
Balance on hand	5
	77

Canine Trypanblue.

	Doses.
Balance on hand last year	176
Made during year	181
	357
	Doses.
Issued during year	291
Balance on hand	66
	357

Kikuyu Fowl Disease Vaccine.

	Doses.
Balance on hand last year	Nil
Made during year	3,734
	3,734
	Doses.
Issued during year	3,734
Balance on hand	Nil
	3,734

Wireworm Powders.

	Doses.
Balance on hand last year	Nil
Made during year	1,600
	1,600
	Doses.
Issued during year	860
Balance on hand	740
	1,600

DISEASES UNDER OBSERVATION THROUGHOUT THE YEAR.

GENERAL STOCK DISEASES.

Streptothricosis.

Distribution.—There appears to be an increased prevalence of this disease in sheep and cattle. Four farms in the Naivasha neighbourhood were found infected during the year. Grade cattle seem to have suffered most, but in one case brought to my notice, sheep were also infected and the mortality amongst them was high.

Two diagnoses of Streptothricosis were obtained from cattle on the Uasin Gishu Plateau, where the disease has been existent in horses for many years.

It has also been diagnosed in specimens submitted from Uganda and the Kericho and Mombasa districts.

Symptomatology.—*Five* affected bovines and eight sheep were received at the Laboratory for experimental purposes, and the following observations have been recorded:

In the case of four cattle the disease affected practically the whole skin of the trunk and head. This distribution similates the equine form. The other cow, however, only shewed a tumefied swelling in the perineal region.

In young calves on one of the farms I visited and where the disease was present, the lesions were confined to the muzzle.

In sheep every case presented lesions confined to the woolless portions of the skin. The muzzle, ears and feet being affected and in that order as regards frequency.

The lesions appear as coniform excrescences usually occurring singly, but in cattle at least, as the lesions become older they become confluent and flatter on the surface, covering large areas of the skin with thick hard crusts.

The size of the lesions vary according to age from a millet seed to a diameter of about an inch.

When picked off the crusts are cup shaped and fit on to a raised point of the dermis, which is of a palish hue and is sometimes covered with a slight purulent discharge. It is in this discharge that the organism is found.

Diagnosis.—Diagnosis is based on a Streptothrix being found in a pure state in the discharge from the lesions.

Transmission.—Attempts were made to transmit the disease artificially from cultures of the organism, but so far without success. Contact-infection experiments are now in progress.

Treatment and Prophylaxis.—Treatment by means of vaccine has been tried in a small number of cases, but so far we have insufficient data to warrant an opinion on its effects. It is also intended to test subsequently the efficacy of dipping fluids as a curative and preventive, since, if successful, this would be a practical and simple measure on farms which possess a dipping tank.

Anthrax.

Only 58 positive cases of this disease were diagnosed against 157 in the preceding year. The majority of those cases occurred during the end of the year, when, owing to the drought, grazing was very scarce.

The occurrence of three cases in Game, two in Kongoni, and one in Gazelle should be noted, in view of the possibility of new outbreaks occurring in clean areas as a result of the extensive movements of the fauna of the country.

Owing to the presence of a Pseudo-Anthrax Baccillus in a large number of specimens submitted for examination, great difficulty has been experienced at times in making a diagnosis.

This difficulty occurred particularly when swabs only were submitted. I would, therefore, advocate the despatch of blood films made from the ear, as well as swabs, in cases where the ear itself cannot be sent with safety.

The Biological reactions of the Pseudo-Anthrax Baccillus have now been practically established, but it has been impossible, through lack of time, to ascertain what role it plays as a disease producer.

Trypanosomiasis.

Ten cases as against forty-seven for last year have been returned on slides submitted for examination, and of these the majority were from Military animals, which we suspect to have been through "Fly" country. The reduction in the number of positive returns is largely due to the comparatively few specimens which have been received from Military sources.

Except for the occurrence of this disease on one farm, in the Naivasha district, no cases have been diagnosed in the Highlands of the Protectorate.

Various strains of Trypanosomes have been kept under observation at the Laboratory in the hope that when our Staff is increased, further investigations may be prosecuted. This branch of our work carried out in previous years is being elaborately dealt with, I believe, in Mr. Montgomery's Report.

Helmenthiasis.

Beyond an experiment to test the efficacy of the method now employed by the Pretoria Laboratory in the treatment of wireworms in sheep little else has been undertaken on this subject. The experiment referred to was not on a large scale, twenty animals only were treated; but it would appear that the doses as applied in South Africa will require regulating in treating our local animals.

DISEASES OF BOVINES.

Contagious Pleuro Pneumonia.

It was considered advisable by the Local Authorities to have the nature of this disease investigated in the Masai Reserve with a view to undertaking preventive inoculations, in the hope of eradicating the disease from the country. Instructions were received from the Hon. Director of Agriculture in August, 1917, and Mr. Bradshaw proceeded to Narok to procure suitable lymph.

Post-mortems were carried out on affected animals obtained from several Manyattas, but in the majority of cases an old septic pneumonia was present: large portions of the lung tissue being destroyed and replaced by a large cavity containing several litres of foeted pus. One or two cases shewing less advanced sepsis were obtained, and the scanty clear fluid in the pleural cavity of these cases was collected and sent here for experimental purposes.

This material was inoculated within 48 hours of collection into susceptible cattle, and, up to date, about seven months afterwards, no reactions of Pleuro Pneumonia have occurred.

An approximately exact repetition of this experiment occurred with material collected by Veterinary Officer Dixon from two Manyattas in the Taveta district. Pleural Exudate was collected from two of the most likely cases and brought to the Laboratory. Inoculations with this material prior and subsequent to filtration were made both intrapleurally and subcutaneously. But no reactions to Pleuro Pneumonia have occurred up to date.

In that district the disease was said to have been of recent origin (Mr. Dixon states about twelve months).

Direct Microscopic, Cultural and Small Animal inoculation methods failed to reveal any particular organism which may be held responsible for the lesions. Numerically, Streptococci were most frequent.

In the light of our experience with the present state of this Epizootic, it seems that if the disease is due to Pleuro-Pneumonia virus, its virulence is now either practically inert or its presence is occluded by other factors as yet undetermined.

Rinderpest.

Beyond an endeavour to ascertain the cause of a high mortality after double inoculation in a private herd treated in November last, other experiments with this disease were not undertaken.

We issued 37,810 doses of virulent blood during the year for double-inoculation purposes to combat outbreaks of Rinderpest in the Protectorate. This is a marked increase over former yearly issues.

The virulent blood used has in most cases been obtained from Control animals purchased in the Rift Valley. As the blood of those Controls usually contains the parasites of Redwater and Anaplasmosis it is often impossible to use this virus in animals which have been dipped from birth, and are susceptible to those diseases. It will be necessary, therefore, when dipping becomes more generalised, to obtain a supply of dipped Controls for virus production.

Blackquarter.

This disease has again been much in evidence throughout the year, and new centres of infection have been brought to notice. Vaccination was carried out in most instances subsequent to cases occurring in the herds treated, the result being that a number of animals succumbed to the disease before protection was established by vaccination. In a few instances it was observed that vaccination by the single method failed to confer complete immunity in all inoculated animals, and the double method was, therefore, employed with apparent benefit. We are now recommending the use of this latter method.

Yearly vaccination against Blackquarter cannot be too strongly impressed upon Stockowners, as the immunity conferred by vaccination only lasts for about one year.

Haematuria.

This condition was studied for the first time at the Laboratory in affected animals sent in for that purpose.

Distribution.—As far as we know at present the disease seems to be confined to the Limuru district. As far back as 1912 evidence of its existence in that district was recorded. In 1916 one farmer reported having several cases amongst his stock, two of which were cows over six years old. In March, 1917, this owner also reported having lost nine head of cattle in the previous twelve months, presumably from the same complaint. It is worthy of note that most of the animals reported by him as affected were cows.

Symptoms.—Four animals in advanced stages of the disease were received at the Laboratory in October 1917. Of these, three were cows of mature years, and the other was an ox which died of East Coast Fever a fortnight after arrival.

Beyond a gradual loss of condition, progressive Anaemia, and the passage of blood in the urine, no other outstanding disturbances were noted.

In all cases the animals maintained their appetite throughout. Powers of locomotion gradually decreased until the animals were unable to rise and death supervened after many months.

The temperature was always normal.

Microscopical examination of the urine revealed blood corpuscles constantly present and only on rare occasions were variations in their amount noted. Actual blood-clots were frequently passed during micturition.

Causation.—Blood examinations made at regular intervals failed to reveal parasites, but indications of Anaemia were always present.

Attempts to transmit the disease by inoculation of large quantities of blood into animals of all ages and breeds were negative. Urine was also injected into the bladder of a healthy cow with no results.

Bladder scrapings collected immediately after death were inoculated into Guinea pigs without effect. Bacteriological examination of all organs failed to reveal an incriminating organism.

Postmortem Lesions.—Except for a general loss of blood causing paleness of all organs the lesions were confined to the urinary tract.

At the autopsy of one of the cows the following lesions were observed.

Kidneys.—The fibrous capsules stripped easily, although in parts they were tightly adherent to the substance of the organ. Both kidneys were markedly swollen, the cortex shewed blood extravasations within its substance as well as small cystic points (probably distended tubules). On section through the organ much fluid escaped from the cut surfaces. The pelvis was distended with apparently normal urine. Both ureters were also full of clear urine.

Bladder.—The bladder was in this case distended to an enormous size. On opening it a few c.c.s. of clear fluid only escaped, the remaining space being taken up by a blood clot which in amount would approximately correspond to five litres of fresh blood. On removing this clot the surface of the mucosa was studded through with raised soft excrescences varying in size from a pin's head to a pea. These growths were the points from which haemorrhage had taken place and their surface was saturated with blood.

The vagina and vulva were normal.

The lesions present in the kidneys in this case were in all probability due to the presence of the blood clot occluding the ingress of urine to the bladder.

In the two other cases postmortemed only bladder lesions, including clot and anaemia of the carcase were observed. All other organs were normal.

Unidentified Diseases.

The occurrence of a "Wasting Disease" clinically resembling Trypanosomiasis affecting cattle in the Rift Valley was brought to our notice during the year, and sick animals were sent to us for observation. Many direct examinations of blood were made, as well as sub-inoculations into healthy cattle of various breeds, sheep and dogs, but all failed to give any indication of the cause of the condition.

Postmortem findings were those of an advanced Anaemia, the cause of which was not apparent.

I visited one affected farm and noted that practically the whole herd, irrespective of breed and age, were shewing symptoms.

The owner informed me that the disease started after the heavy rains of 1916-17. I also obtained native evidence that that part of the country in the Rift Valley, which included the farms on which the disease was noticed, has been known by them for a long time to be unsuitable for cattle raising at certain periods. I advised the Owner, whose farm I visited, to transfer a number of affected animals to Escarpment, and to inform me of the results. After a few months he reported that these animals were quickly regaining condition. Subsequently similar evidence of recoveries have been noted by Stockowners when animals have been removed from that area. Indications lead me, at the present time, to assume that the casual factor may be found in some deficiency in the normal elements of grazing.

EQUINE DISEASES.

Donkey Anaemia.

Beyond keeping various strains of this disease going, we have been unable to carry out further experiments on old standing strains, since the departure of Mr. Montgomery, who is, I believe, treating the work already done on the subject in his Report.

A condition clinically resembling this disease has, however, been reported to us by the Animal Transport Depot, Nairobi, who state that Donkeys arriving in Nairobi from German East Africa lost condition very rapidly, and have shewn signs of great weakness when put to work. Some were stated to have recently been imported from South Africa, and to have only spent a short time in the conquered territory before their transfer to Nairobi.

Trypanosomiasis, which was suspected as being the casual agent, has now been eliminated, and it would appear from the few experiments we have already carried out that the condition is probably Donkey Anaemia. Further experiments are, however, in progress.

Ulcerative Lymphangitis.

The treatment of this disease by a Polyvalent vaccine prepared in the ordinary way from cultures of the Bacillus Priez Nocard, has been carried out on animals at the Laboratory with good results.

From our present experience it seems that a complete cure can be obtained in approximately 80% of recently affected animals, irrespective of the extent of the lesions.

When the disease, however, assumes a chronic nature and settles as it does in many cases, in the limbs, particularly the hind legs, causing a thickening of fibrous tissue, treatment has but little effect. In such cases counter irritants in the form of strong blisters have sometimes given beneficial results, but as a rule prognosis is not hopeful.

An experiment to actively immunise horses against the disease was carried out by Messrs. Montgomery and Bradshaw before my arrival from leave. 30 horses, the majority being South African bred, were divided into ten batches of three animals each. In each batch two animals were immunised, and the third acting as a Control received no preventive treatment.

Two methods of immunising were adopted, one by the injection of polyvalent living cultures of the Bacillus Priez Nocard, and the other by alternate doses of a polyvalent vaccine and living cultures. Both inoculations were made subcutaneously on the neck, and were carried out at three day intervals until the cessation of abscess formation subsequently to inoculation. Increasing doses of the organism were injected up to a maximum of 25,000 millions per dose. At the completion of this course of immunisation the horses were distributed to Settlers on highly infected farms on the Uasin Gishu Plateau; control animals living under the same conditions as the inoculated ones, and all the animals were exposed to daily infection. Up to date, about six months afterwards, four animals have contracted Ulcerative Lymphangitis, two of those are controls, and of the remaining two one received mixed vaccine and virulent culture, and the other received the virulent culture only. Th experiment is still in progress.

Treatment according to the methods of Truche was tried on six animals four recent and two old standing cases. The results were very disappointing, as no improvement in lesions were noted.

It would, however, be unfair to deprecate the efficacy of this method without repetition of the experiment on a larger scale.

Epizootic Lymphangitis.

The treatment of this disease continued throughout the year with very encouraging results. The following recipe is that which was used:—

Hydrargyri Iodidum Rubrum, Gramme one—Potassii Iodidum, Gramme five—Aquae, Ounce one.

This dose was given in a mash every morning until the lesions began to dry up, when dosing stopped. This period of dosing averaged about one month in cases shewing moderate lesions. A continuation of the dosing was carried out if improvement was not progressive.

Symptoms of mercurialism have been shewn by one animal, and then only when the administration of the drug was carried out for a very long period.

The following is a Summary of cases which were treated during the year:—

Species	*Lsb. No.*	*Lesions.*	*No. of doses received.*	*Result.*
Horses	700	Slight	12	Complete Recovery
,,	817	,,	21	,,
,,	850	Extensive	60	,,
Mule	821	Medium	60	,,
,,	823	,,	39	,,
,,	824	,,	39	,,
,,	825	,,	19	,,
,,	826	Extensive	60	,,
,,	846	,,	60	,,
,,	847	Medium	60	,,
Horses	816	Extensive	60	Developed symptoms of mercurial poisoning after 39 dosings. Still under treatment
Horse	818	Extensive	61	Still under treatment but apparently recovered.
Mule	857	Extensive	21	Still under treatment
,,	860	Medium	21	Still under treatment

Treatment after the method of Velu by the subcutaneous inoculation of Aetherised pus was tried on four mules, but as those cases were very advanced and death of two animals occurred from other causes before the treatment was completed the experiment was discontinued, a repetition is necessary to establish the effects of this process on Epizootic Lymphangitis as occurring in the Protectorate.

DISEASES OF PIGS.

Swine Fever.

Swine Fever was again taken in hand in the hopes of obtaining immune pigs with a view to establishing a method of inoculation similar to that practiced with so much success against the disease in other countries.

We were very unfortunate in losing some hyperimmune pigs through Contagious Pneumonia, which was brought into our styes by a batch of pigs that were said to have survived a natural outbreak of Swine Fever. One Sow only survived, and we have been lucky in establishing in her a high degree of immunity. She is now receiving virus subcutaneously without ill results, and it is hoped her serum may be of great value in immunising others.

I would remind all Pig Breeders of the serious consequences if this disease becomes more widespread, and trust that thy will help us to procure a specific inoculation against it by sending any pigs which may have survived a natural outbreak.

As has been reported previously, the greatest difficulty so far encountered in establishing a method of inoculation such as is practiced at home lies in the fact that the disease in this country is of such a virulent nature that the usual methods of immunisation require modification.

SHEEP DISEASES.

Goitre in Lambs.

In 1909 this condition was observed by Montgomery in the Molo district, and as I cannot trace any reference to it by him in previous Annual Reports, I consider it of so much interest that I give below an extract of his Report thereon.

CONGENITAL GOITRE IN LAMBS.

MR. MONTGOMERY'S REPORT.

"The farm on which this condition occurred is situated some 16 miles from Molo Station, and about 800 feet above sea level.

"Prior to the autumn lambing of 1909 no cases of Goitre had been observed. Lambing season commenced on the 1st October, and lasted for about six weeks, the weather was good throughout the whole period, and only very little rain fell and that towards the latter end.

"280 ewes were in the lambing flock, and from them 240 lambs were born. Of these 85 manifested the condition when born, 82 died within a few days, and in three the swellings gradually disappeared, the lambs recovered and were alive eight months later.

"In no case did the disease develop after birth, but in every instance the lamb was born affected. The condition occurred in both male and female lambs, but the three which recovered were all males.

"Twin lambs are rare in this district: 84 cases occurred amongst single lambs, and only one case in twins. This latter was a male lamb born of a ¼ bred ewe; the twin lamb, a female, was born free from the disease, and has never manifested any symptoms.

"With one or two exceptions the affected lambs were alive at birth. The great majority of cases are unable to stand or to feed, exceptionally they live for a few days, and in two instances only they lived for a week.

"In all cases the lambs were small and weakly, and in those which lived for a few days no premonitory symptoms were manifested, but death ensued without warning.

"*History of the Flock.*—The flock consisted of 270 native Masai ewes purchased from the Uashin Gishu and Likipia Reserves, and ten ¼ bred merinos which had been reared on the farm.

"The Laikipia ewes were introduced in February, 1907, the Uasin Gishu ewes were introduced in January, 1909, and were in lamb to native rams, to which normal young were thrown, in the spring of that year.

"The ewes had been mated to Romney Marsh rams, which had been imported the previous year, and to ½ bred Merino and half bred Corridaly which had come from the Soysambu Estates a year before.

"Rams from Soysambu had been used by many sheep men without any cases of this affection being observed.

"It would appear, therefore, that neither the rams nor the ewes could *per se* be incriminated, and no cases of the disease occurred on any neighbouring farm.

"My attention was drawn to a ¼ bred Merino Masai ewe which had been born on the farm in November, 1907, and lambed normally to Corridale ram in May, 1908. In October, 1909, she threw twins to Romney ram. The female was born affected and was dead at birth; the male was free. In the next lambing in June, 1910, she again threw twins to the Romney. The male lamb was again free, and the female was born affected. This ewe lamb when seen by me was ten days old. It had been weaned from the mother and was being bottle reared and was in good condition. Each thyroid was about 5.5 c.m. long and 2 c.m. in thickness, freely movable under the skin and on the trachea. There was no enlargement of the lymphatic glands.

"A Masai herdsman stated that he seen the disease before but this should be received with caution as other men denied it. The informant, however, affirmed that it was known to the Masai, who treated the condition by rubbing the swellings with the crushed leaves of a tree known as "Ol Galai."

"A Masai headsman stated that he had seen the disease before the 15th June, 1920. The lamb was a single one and appeared well developed. To the naked eye the neck appeared as large as the head, and the angle of the jaw being hidden by the swelling of the throat. The lamb could stand, walk about and feed from its mother. On manipulation the swelling was found to be due to two moveable bodies about the size of a hen's egg situated on each side of the trachea in the position of the thyroid gland and connected together by a thickened band. The lamb was killed for post mortem observation.

"The enlarged thyroids were seen lying on each side and to the under surface of the thyroid cartillage and the first four lines of the trachea.

"The left lobe was slightly in advance of the right, the farmer measured 5.6 c.m., the latter 5.9. Each was about 2.25 in diameter. On cross section the outline was nearly spherical, being, however, slightly flattened on the tracheal surface. In colour the bodies were the normal dull brick-red similar to the thyroid. They were firm to the touch and cut in clean section with a knife. The surface was mottled by small paler areas up to 0.2 c.m. in diameter which were subcapsular and shewed no evidence either of bulging or of contraction. On section the organ resembled sponge cream, the trabeculae being separated by the cystic or colleidal areas."

An identical condition was noted in September of 1917 about 20 miles from Gilgil Station amongst a flock of Grade Lambs.

The macroscopical appearance in this instance, was according to Montgomery, identical to that seen by him in 1909. As our observations of this latter outbreak were curtailed owing to insufficient staff, I am only able to give the following information on it.

The Owner reported that the lambs appeared to be born with it. Both Thyroids were usually affected, and in bad cases swelled to the size of a man's fist. Death appeared to be caused by choking. The mortality was very high, and the big rainy season just before seemed to have some connection with the cause of it. Observations at the Laboratory were confined to two lambs a few days old, which were received towards the end of September. One lamb was dead on arrival, the other was bright and vigorous, and shewed a firm subcutaneous swelling about the size of a duck's egg immediately below the Rami of the maxillae and lying on the trachea. The swelling was moveable, but was loosely attached. Six weeks after receipt this swelling had gradually and completely disappeared, and the animal remained otherwise normal throughout our observations.

The post mortem findings of the other lamb were as follows: The carcase was tympanitic, rigor mortis was complete, there was a slight discharge from the mouth, which was clenched. Behind the throat, situated on the trachea, was a large softish subcutaneous swelling about the size of a mangoe. On dissecting the skin a glandular cystic tumour was detected with a connective tissue attachment to the trachea on which it laid, about half on either side. The blood supply was the carotoid artery and it drained into the jugular vein. On opening one of the cysts or sacs a greenish brown liquid exudate was noted which contained a cloudy suspension. At the bottom of this sac about 40 c.c.s. of clotted blood was present. Other sacs of the growth were not opened. Examination of cover-glass preparations and stained smears from the contents were negative.

FOWL DISEASES.

Kikuyu Fowl Disease.

Kikuyu Fowl Disease appeared very prevalent throughout the year, and preventive measures in the form of vaccination were largely practiced by Owners, with beneficial effects.

One instance only has been brought to my notice where a recurrence of the disease took place in vaccinated fowls, and in another the vaccine did not appear to check the disease, which was already present at the time of inoculation. Beyond those, however, no other adverse reports have been received.

The vaccine is a living culture of the casual organism, which is a member of the dysenteric group. It is used at present in three consecutive doses at ten day intervals, a culture of about six months old is used as the first vaccine, three months old for the second, and a freshly isolated culture for the third.

I have the honour to be,

Sir,

Your obedient servant,

W. KEARNEY,

Acting Veterinary Pathologist.